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Army Intermediate Depot

Labor and Supplies

Big Caissons Sunk for Kansas City Bridge

There Is No Light Like Daylight

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Volume 81 September 12, 1918 Number 11

Engineering News-Record

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E. J. MEHREN, *Editor*
CHARLES WHITING BAKER, *Consulting Editor*

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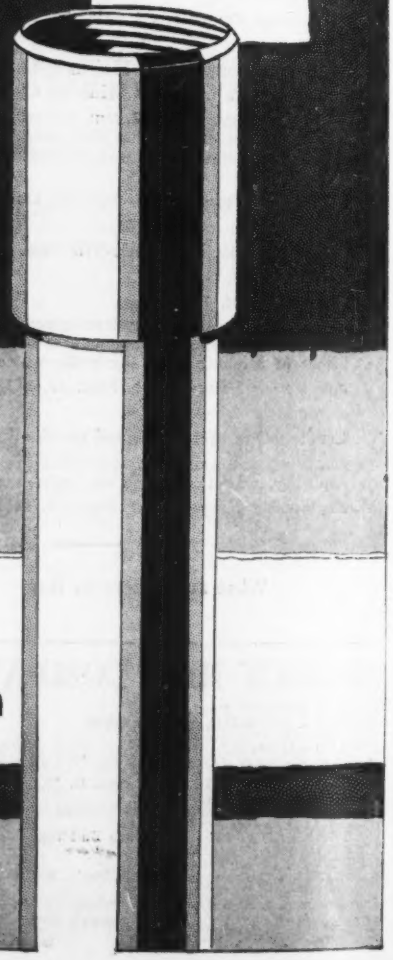

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ENGINEERING NEWS-RECORD

A WEEKLY JOURNAL
DEVOTED TO CIVIL ENGINEERING
AND CONTRACTING

E. J. MEHREN, *Editor*

CHARLES WHITING BAKER, *Consulting Editor*

Volume 82 — NEW YORK, THURSDAY, SEPTEMBER 12, 1918 — Number 11

A Red Letter Day

MILLIONS of men are registering today for the final drive against Germany. The flower of the manhood of the country will place itself on the service roll to fight abroad or work at home as the highest need may dictate. Engineers will do their part. They are fortunate, for working or fighting they are a most necessary factor in winning the war.

Preparation

ENTHUSIASM and united action will make the Fourth Liberty Loan Campaign a success. Suggestions for win-the-war meetings in every engineering and industrial organization before the drive begins will be sent to all who mail us the coupon printed on advertising p. 85. Do *your* bit!

Power Will Help Win the War

BEHIND all of the things that bill-poster slogans tell us will win the war lies power. Ships cannot be launched, food cannot be produced, airplanes cannot be built, munitions cannot be forged, without the all-moving power that drives the war plant. But this power for many months has been sadly deficient. Economies of operation have been practiced, and non-essentials have been reduced, but the basic fact remains; more power must be produced. Government authorities who realized this months ago have at last openly recognized that private interests can no longer command the necessary capital and the Sims Bill, appropriating $200,000,000 to acquire, enlarge and develop power, is the result. Properly safeguarded against permanent Government ownership—which is a question to be left to calmer days—this bill should pass and pass quickly. Even now it is too late to initiate new schemes which will become effective within the year. But there is still ample time to assist financially projects already under way and to insure a coöperation or consolidation possibly not feasible under existing laws. Power may not win the war, but without it the war is surely lost.

Acquiring Utilities for Condemnation Proceedings

MUNICIPAL acquisition of public utilities by condemnation is so unusual that attention may well be called to the short article on p. 483 which tells of the decision of a California court which upholds the right of cities in that state to acquire utilities in that way. Unless the decision hangs on some state constitutional provision peculiar to California it merits the attention of those interested in public utilities on both the municipal and the private ownership sides.

Philadelphia Bank Urges Water Meters

PLEADING for the great army of industrial workers, the Corn Exchange National Bank of Philadelphia in its August bulletin urges the universal water meter system for Philadelphia as a means toward insuring an ample supply of pure water. It is quite unusual for a bank to join in a campaign for water meters. The Philadelphia Bureau of Municipal Research is continuing its work for meters by the publication of leaflets. The Philadelphia *Evening Ledger* has recently come out unreservedly for water meters for the first time. Altogether the outlook for the universal meter system at Philadelphia is most encouraging. Water saving will help win the war and help greatly in the reconstruction period also. It is time that Chicago, Buffalo and other water-wasting cities besides these and Philadelphia began to cut water waste, at the same time saving coal and labor greatly needed for other purposes.

Help Study Reconstruction

BREADTH of vision is shown by the definition of reconstruction and plans for the study of its problems given in the official announcement of the Reconstruction Committee of the National Council of Research on p. 511. The committee desires suggestions of possible reconstruction fields and agencies. Such an opportunity for service should be seized.

Regulate Traffic by Zone Systems

SEGREGATING street traffic by zones is quite out of the ordinary. An order, which will go into effect in New York City, Sept. 16, sets aside for the use of passenger vehicles only, ten north-and-south avenues through the central portion of lower Manhattan. The remaining twelve avenues, bordering the zone on either side, together with one in the midst of the zone, are assigned to commercial vehicles. Each type of vehicle can enter the district of the other only by the intersection nearest to its destination and must leave by the nearest intersection. This innovation is noteworthy on account of the size of the zones established, but more particularly because light traffic is forbidden in the heavy-traffic zones—an uncommon restriction. By separating high- and low-speed traffic the plan will doubt-

less aid passenger vehicles and may help ordinary trucks but the high-speed commercial vehicle, which runs as fast as is allowed by law, may be held up by the concentration of more slowly moving trucks. The experiment will be watched with interest throughout the country.

Does the Railroad Need the Motor Truck?

ADVOCATES of road building and more extensive use of motor trucks to relieve the railroads in a measure will learn with surprise and dismay that Theodore H. Price, speaking for the Railroad Administration in a defense of it against a newspaper charge of inefficiency, declares that he doubts whether shippers are sending their goods in unusual quantities by motor truck, and asserts that if they are it is not because of lack of railway transportation. On the contrary, he says, the administration has been urging merchants to take advantage of the present carrying ability of the railways to stock up against their winter's needs, when weather conditions make train operation more difficult. Whether or not the total ton-mileage of motor-truck transportation is much or little compared with the total of rail transportation, there seems to be more than one instance where the motor truck has saved the situation for an industry or a considerable part of a community. It is difficult to predict what the future demands for transportation are going to be. It seems reasonable to expect that at some if not many points motor-truck transportation will continue to be a valuable auxiliary to rail and water transportation and that roads should be built and maintained accordingly. But in the present emergency it is more important than ever that each case be given thorough and intelligent engineering study.

Common Sense and Essential Industries

BY FAR the most important action taken by the War Industries Board since its initiation is the common-sense classification of essential industries which that board announced Sept. 9 for the immediate purpose of guiding exemption officials in making the second draft. Not of first importance is it that at last the Government has undertaken to say what is essential—the word for which industry has waited fifteen months; not of greatest moment is it that a comprehensive list of industries has been issued, to which, with minor exceptions, everyone will agree. Of chief import is the single statement in the explanation accompanying the instructions, "All priority is relative, and implies purposeful discrimination." It summarizes the present point of view of Washington with reference to war-time activity—a point of view which is a great advance over the confused ideas bred by the first few months of conflict. The great thing is, that now a selection of the sheep from the goats has at last been made, the Government has stated in no uncertain terms that the new classification is never to be arbitrary, but is to be a living, growing thing, keeping pace every step with the needs of war and of the country at large. Some things most essential in themselves are not to receive blind preference, because an oversupply is being produced, and we can afford to cut down on them. Other things, far less directly essential, but of such a nature that a shortage at the present time would react seriously on the war, receive the coveted priority until such time as increased production has placed us out of danger. With such a common sense administration of priorities in man-power and materials, we need have no fear. Our strength will not be impaired by killing non-essential activity under such a program, but rather will be conserved by converting non-essential production to immediate war uses, and by continuing the conversion in a never-ending adjustment to keep pace with changing needs.

The First Final Railroad Valuation

SCARCELY more nourishment is afforded the railroad corporations by the first final valuation report of the Interstate Commerce Commission, that on the Texas Midland R.R. (see p. 488), than they had from the first tentative valuations of two years ago. Certain unit prices have been increased, the Bureau of Valuation itself being convinced that the tentative figures were too low. Original cost, which the tentative report said could not be found, has nevertheless been found, but the companies were less interested in this than were the state commissions. In most other respects the findings of the bureau in the tentative valuation are sustained by the commission.

Several new reasons are advanced for the old conclusions. One of the least satisfactory of these from the companies' point of view is the justification of the deduction of depreciation. No answer is made to the railroads' contention that the value lies in the use made of the property, and that where there is 100% efficiency of use it matters not that half the service life is gone. Instead the commission contents itself with discussing what courts and other commissions have meant by depreciation. Manifestly the commission must report what the law prescribes (which it does not seem to have done in the case of land), but if the law is incompatible with justice, or if the figures the law calls for are likely to be wrongly applied, that fact or those facts could well be recorded by the commission.

In reporting "present value" of land instead of the reproduction cost the valuation act calls for the commission begs the question. Reproduction cost of the railroad is not reproduction cost of the railroad unless it includes land. The carriers were ready with plenty of evidence that railroad land does cost much more than the market value of contiguous land; and the commission was admittedly aware that it does. Inability to determine whether such market value should be tripled or quadrupled is no excuse for evading the whole issue. It is unfortunate, however, that the railroads did not rest their case on a simple argument for a multiple.

Failure to record "other values or elements of value," as the act also prescribed, does not come in the same category. The bureau did not find any, and the carrier, though invited to do so, did not submit any convincing evidence of what they amounted to. Considerable testimony along these lines was presented in the

Kansas City Southern case (see *Engineering News-Record* of Aug. 8, p. 277), and it remains to be seen whether this road will fare any better. As its witnesses all agreed that the sum of these other values could be found only by subtracting the sum of the tangible values from a total value based on sheer judgment—in other words, that reproduction cost itself has little or no bearing on final value, and that there is no such thing as building up a valuation on cost figures and estimated intangibles—*Engineering News-Record* suspects that it will not

Contingencies, working capital, appreciation—all of these the commission admits to be realities for a railroad to be built, but all of them it explains out of the valuation; they could be avoided in reproduction, or they are operating expenses. The logic is no more convincing than when first put forth. In the cases of engineering and general expenditures the commission leans the other way in its determination not to concede too much. By its own studies it shows averages for these items of 3.6 and 1.9% respectively—and then it allows 2.15 and 1.5 per cent.

Altogether the first final valuation gives little encouragement that the valuation will go far toward solving the manifold problems that prompted Congress to pass the valuation act. Only part of the property is on record, and that is not all in the same terms. It is to be hoped that the commission will yet, when some of the more important roads come before it, revise its views and at least record all the facts.

Contractors and War Service

UNDOUBTEDLY the most important reason for the immediate formation of a national association of contractors is the opportunity, and indeed the necessity, for war service. From more than one Government source has come the intimation that not merely the contractors, but also the war work of the country was suffering because there was no war service committee of contractors. There is little doubt that the formation of such a committee would be looked on with favor in most quarters at Washington. Neither is there any doubt that no representative committee of this sort can be called into existence unless contractors themselves take the initiative.

Yet, while the War Industries Board is maturing comprehensive priority machinery for converting every industrial activity that can serve, now or later, to carry on the war or to sustain the life of the country, while the essential character of motion pictures and fiction magazines is being put on an unquestioned footing, it would almost seem that Government agencies are engaged in stamping out construction work as men stamp out a conflagration, turning a fresh stream of cold water on every project that shows its head. Certainly the effect could hardly be worse were there deliberate intention behind acts such as that of the local capital issues committee which stopped, just because it was construction, projects considered necessary by other officials, or that which recently threatened to end all concrete construction in an important state by ordering mills to stop all cement shipments at once, leaving owners and contractors no recourse but to disband construction forces and resort to a long fight to have the order modified in single cases.

The apparent feeling that construction work is about the most useless of all activities has had the practical effect, whether intended or not, of a crusade against all projects involving new building, before which nothing could stand except work defended vigorously by the War Department, the Navy or the Shipping Board. The big contractors, being in the nature of things engaged on work under the protection of these powerful agencies, have not felt the pinch, and remain indifferent to the need for a real analysis of the situation.

All will admit that there is much construction work which can and should be postponed till after the war. All will admit, too, that there is much construction work not directly required by the Government agencies mentioned which must be done, unless the country wants to face in the near future the certainty of having its war efforts cramped by the wearing out without replacement of our national plant, including transportation, housing, industrial and municipal facilities of every sort. No one, however, is now giving the necessary thought to the problem of where to draw the line. As a result, when the immediate needs of the Government for mushroom building are satisfied, contracting faces the danger of extinction. Of course, when peace comes, new organizations will spring up, and many old ones will get back into the game, at least as names. But for the most part, the men and organizations will have to be replaced and rebuilt from top to bottom. And the work that should have gone on, which would have served to preserve the industry, and for lack of which the entire nation will be a heavy loser, will have gone into the discard.

These are no theories. Contractors and the country will suffer just these consequences unless someone able to pick out the new construction which is really necessary shall step to the front in time to avert them. No one can do more toward establishing the correct policy toward new work than a really representative war service committee of contractors. They could point out to our Treasury Department that Canada is now rushing construction on one of the world's largest hydroelectric plants; and wisely, though that plant cannot develop one kilowatt of power for years to come. They could contrast this policy with that which put the ban on all such developments in the United States because the war will be over, in the opinion of some officials, before the plants could be finished. They could show in what districts the deterioration of roads would have a serious effect on crop yields. They could champion the cases of industries able to pay in short order for new building through increased production efficiency. They could at least establish the mechanism for collecting information on such subjects, and supply the agency for investigating questions of this sort, which cannot be settled in the present out-of-hand manner without evil consequences sure to affect the war and to persist for a long time afterward.

How soon will contractors act to give the Government this help and this information? No one but themselves can be blamed for the consequences to the industry and the public if they do not step into the breach at once in an organized effort to render constructive war service.

Army Intermediate Depot in France Problem in Getting Labor and Supplies

Project Covers Site Six Miles Long—Three Types of Warehouse Are Being Built—Chinese Labor Used on Railway Grading—Installation Completed for Storing 5000 Tons of Beef at Zero Temperature

By Robert K. Tomlin, Jr.
War Correspondent of Engineering News-Record

Photographs not otherwise indicated are from Committee on Public Information.

TO PROVIDE storage and railroad yard facilities at a point midway betwen the front line trenches and the United States Army seacoast bases in France where supplies and equipment are unloaded, engineer troops, assisted by labor units of several nationalities and German prisoners, have partially completed the construction of what will be, eventually, the largest of the so-called "depots" for the American Expeditionary

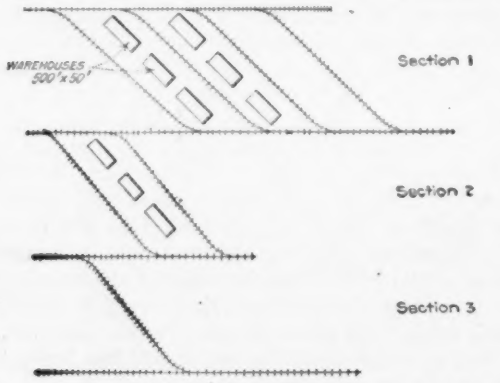


FIG. 1. SKETCH SHOWS TYPICAL LAYOUT OF WAREHOUSE SECTION OF ARMY INTERMEDIATE DEPOT

Forces. This is the intermediate depot, where reserve stores for the engineer, quartermaster, medical, signal, ordnance and the various other special services of the Army are delivered, held until needed, and then shipped to points of use.

In previous articles, on the advance depot and the docks, storage and railroad yards at one of our base sections, I have outlined the general purpose and relation to one another of the several "depots" for our overseas supplies. It is, therefore, unnecessary to go into details as to the function of the intermediate depot. Suffice it to say that it is, in effect, a vast storage and regulating reservoir of materials of all sorts upon which the draft from day to day varies, depending upon the needs at the front and at other places in France where American army activities are under way.

The intermediate depot must be equipped to meet hurry calls for almost anything in the form of food or supplies. On the heels of a requisition for canned beans in car-load lots may come a demand for a shipment of cast-iron pipe, specials, and valves for a water-supply project. To meet such demands involves the provision of millions of square feet of covered and open storage and the creation of railway yard facilities for delivering and taking away the almost endless variety of products called for by the war program upon which we are engaged. Aside from its tremendous size the intermediate depot is unique in that it contains the largest refrigerating plant in France—a plant with a capacity of storing at a temperature of 0° F. 5000 tons of fresh beef.

Even over here in France it is hard to visualize the vast extent of the construction program which our engineers have laid out, and of which the intermediate depot, though a big project, is only a part. One journeys from place to place between the seacoast and the front, and all along the line the work of the engineer is in evidence. I have covered by railway, motor car and "hiking" a good many thousand miles since I landed in France, and even to-day there are many sites where construction is in full swing which I have not visited. There are others, too, I will venture to say, of whose very existence I am ignorant—and this in spite of fairly steady contact for six months with engineer officers grading in rank from second lieutenant to major general. The thing is appallingly big to "cover" in any comprehensive way. We can pick out jobs here and there for description, in an attempt to give our engineers in America some idea of the main types of construction which our technical troops in France are doing, but under present conditions it would take a sizable staff of men to record in adequate fashion the

FIG. 2. WOOD-FRAME WAREHOUSE HAS HOLLOW TILE WALLS

engineering work which is being done for the American Expeditionary Forces.

Take for example the single project of the intermediate depot. In plan it is a diamond-shaped layout 6½ miles long and 1¼ miles wide. The plans provide for more than 200 warehouse buildings, each about 500 ft. long and 50 ft. wide. These dimensions are only approximate, for there are buildings of several different types, but, on the average, they are of about the size indicated. Coupled with the building construction is the matter of laying about 225 miles of railway track to serve the warehouses.

With the exception of the refrigerating plant, however, the depot problem presents nothing difficult in the matter of engineering design. The wooden buildings

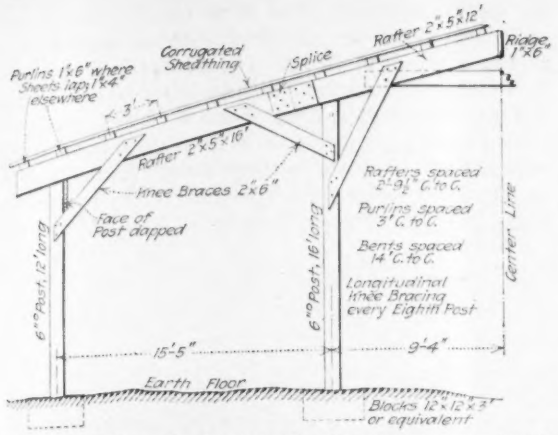


FIG. 3. TYPICAL CROSS-SECTION OF WAREHOUSE SHED

are of extremely simple types, and the railroad yard grading and track laying has been principally a job of obtaining materials and handling labor, rather than one of elaborate technical detail. This does not mean that the work has proceeded in any haphazard way, but rather that it has been studied with a view to eliminating anything savoring of "fancy" engineering or construction. The main large-scale map of the yard layout, for example, is one on which all unnecessary draftsmanship has been omitted. It is a straight "working" drawing. Tacked down upon the rough plank table in the shack which serves as the headquarters of the commanding officer of the engineer troops and his principal assistants, the paper has been worn through in spots by the elbows of the men who have to consult it regularly and mark up progress. No one has had time to make a new drawing. The holes in the old one are patched up with adhesive tape as they develop, and the work goes on.

As to the layout of the warehouses and the tracks the plan shows the work divided into five sections, four of these being parallel bands running in an east and west direction, and the fifth extending diagonally along the western ends of the others. In addition, there is a special yard for the storage of engineer material. Between pairs of parallel east and west track the warehouses, generally in groups of three, are placed end to end as shown in the accompanying sketch (Fig. 1). At the time of my visit early in June there had been laid about 60 miles of track, and 80 warehouse buildings were finished. During the early stages of the job about 15 miles of rail had to be obtained from the French, but at the present writing 80-lb. steel rail from the states is being employed exclusively. The same situation existed in the case of wooden ties but now, with the work of our forestry service speeding up the production of lumber from local sources, the tie shortage is being relieved.

The grading of the railway yards has been done both with small hand tools, pick, shovel and wheelbarrow, and with the aid of heavier plant such as locomotive cranes and clamshell buckets, and road graders hauled by caterpillar tractors. The labor represents many nationalities. In addition to our own service battalions there are large gangs of Chinese on the job. While the site of the yards is fairly flat, large areas were originally covered with brush and small trees, necessitating a considerable amount of grubbing. On this work of clearing and grubbing, as well as that of digging drainage ditches and grading the earth floors of the warehouses, the Chinese were used. Labor of higher grade, both negro and white, was reserved for the more difficult jobs of track laying and ballasting. However, a few of the Chinamen were employed on tasks demanding some degree of mechanical skill; for example, in assembling a few road graders and concrete

FIG. 4. ENDS OF WOOD-FRAME WAREHOUSES ARE SHEATHED WITH CORRUGATED IRON BUT SIDES HAVE ONLY CANVAS COVERS

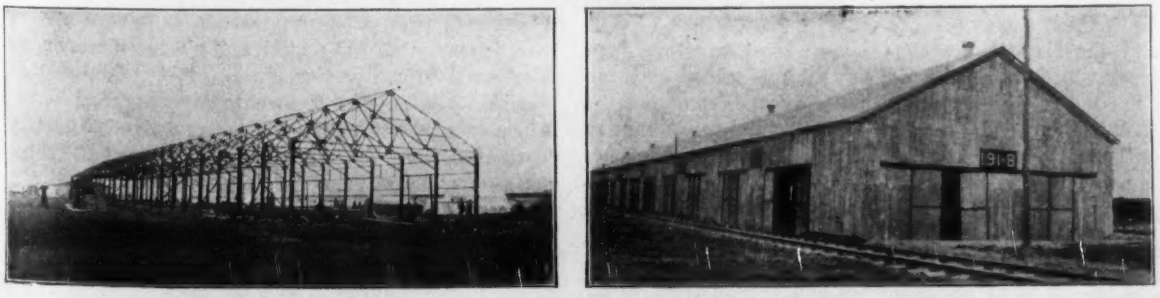


FIG. 5. STEEL FRAME WAREHOUSES ARE SIMPLE IN APPEARANCE

mixers. The major of engineers who made this experiment told me that the Orientals became intensely interested in putting together the parts of American machinery, and often they worked hours overtime tinkering with the equipment which had been entrusted to them.

The track layout of the yard involves the provision of two humps and two separate groups of receiving, classification and departure yards, one for east-bound and the other for west-bound traffic. The hump starts with a 4-per cent grade which is eased off in 100-ft. stretches to 1 per cent. Among the accessory structures for the railway yard are engine sheds, coaling stations, inspection and repair pits.

For the warehouses there are three different types of structure: (1) wood frame with open sides and corrugated iron roofing; (2) steel frame entirely sheathed with corrugated iron; (3) wood frame with walls of hollow clay tile or cement blocks. The steel and the clay-tile warehouses are used to store supplies which would be damaged by wetting, such as flour and sugar in sacks. The open wood-frame houses, on the other hand, are suitable for the storage of canned or boxed goods. The steel-frame structures serve as fire-stops, being interposed here and there between the wooden structures.

The wood-frame warehouse is merely a shed formed by timber bents and corrugated roofing, as shown in Fig. 3. Most of the posts are young pine trees, 6 in. or less in diameter, obtained on the site during the clearing operations and stripped of their bark. The ends of each warehouse are sheathed with corrugated iron sheets, as shown in Fig. 4. The sides are not sheathed. As a means of protection for the material placed beneath this form of shelter large sheets of canvas are hung from a point beneath the eaves and extend down to the ground level, as shown in the picture. On this job, as on all others which have been undertaken by our engineer troops in France, scarcity of materials was one of the conditions which we had to face. As one of the majors of an engineer regiment at the intermediate depot expressed it to me, "Our principal difficulty has been to put the job through using only about one-half the original bill of material."

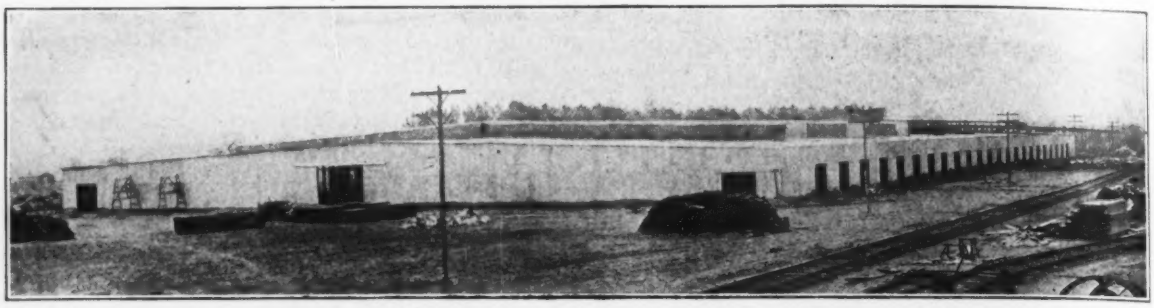
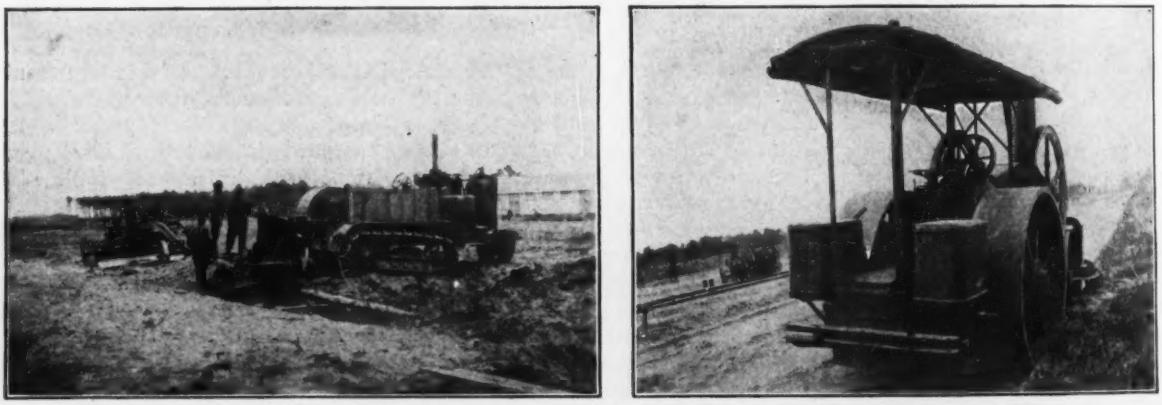


FIG. 6. ONE OF THE VERY LARGE STEEL FRAME WAREHOUSES SHEATHED WITH CORRUGATED IRON

In the sketch showing a typical cross-section of a warehouse shed (Fig. 3), it will be noted that the sizes of the various members are given. This means that such sizes are used when they are available, which is not always the case. In this type of warehouse no roof truss is employed. The rafters, 2 x 5 in. in section, are kneebraced to the vertical posts. It is practically impossible to obtain in France to-day long timber, and in the case of the warehouse rafters a splice is introduced as shown. The purlins are spaced on 3 ft. centers and are usually of very light material. The corrugated roofing is nailed to them.



Photographs by Engineering News-Record

FIG. 7. GRADING DONE BY AMERICAN ROAD GRADER HAULED BY CATERPILLAR, SHOWN ON LEFT, AND ROAD ROLLED BY AMERICAN MACHINE, IN VIEW AT RIGHT

Many of the storage warehouses at the other depots of the American Expeditionary Forces in France are raised above the ground level on posts, or are provided with depressed railroad track along both the incoming

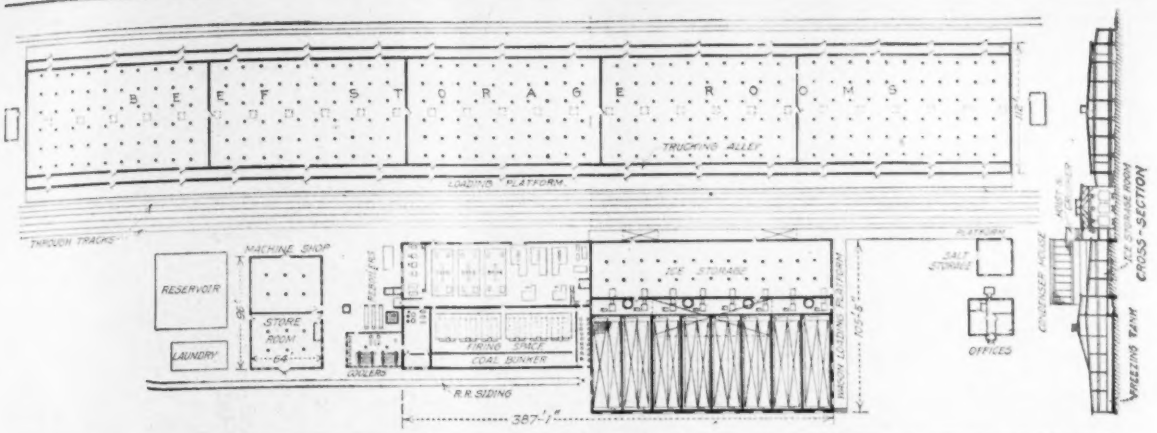


FIG. 8. LAYOUT OF THE HUGE REFRIGERATING PLANT BUILT BY AMERICAN SOLDIERS IN HEART OF FRANCE

and outgoing platforms, thus making the warehouse floor level the same as that of the freight car. In the case of the present wood-frame warehouses at the intermediate depot this practice has not been followed; as a general rule, there is no flooring other than the earth at the original ground level. In some cases, logs are placed on the earth floor in parallel rows to raise cases of goods a few inches above the ground.

More substantial types of warehouse are shown in Figs. 5 and 6. Those of the hollow-tile type were built for us by French contractors. In the steel-frame type of warehouse all connections are bolted rather than riveted, and the structure is sheathed on roof, ends and sides with corrugated iron.

The first lumber for the warehouse construction came from the United States, but since these early shipments a certain quantity has been secured from Swiss and French sources and from American forestry regiments. As a general rule, about five warehouses of the wood-frame type are under construction at one time, and to each building a gang of 60 or 70 men is assigned. Portable saw-rigs have been used for the framing work and have proved decidedly useful. Very little concrete is used on this job, the principal demand for it being at the refrigerating plant, in the footings for the columns of the steel-frame warehouses and for the inspection and engine pits for the railroad yard.

At the time of my visit to the intermediate depot, warehouses of the three different types, wood-frame, steel-frame and wood-frame with hollow-tile walls, had been built and were in service. About 25 locomotives were being used on the railway yard operation and construction, and shipments in large volume were being received, stored or routed for the front. One of the depot's biggest days occurred on June 13, when 520 cars were loaded and hauled out.

A very large labor force has been required on the depot construction work. I was told that the force, at times, has exceeded 10,000 men. Of course, this number does not remain constant. The situation over here is one that is characterized by shifting, sometimes sudden, of units from one place to another. For example, the work at the intermediate depot was begun by one of the regiments of railway engineers which were among the first to arrive in France a year ago. A few of them, principally officers serving in administrative capacities or as superintendents of big labor gangs, are still on the job. The rank and file, however have left for other parts. While a great deal of the grading work for the railroad yards has been done by hand labor, mechanical plant is to be seen at work here and there. For example, in one section the roadbed for the track is

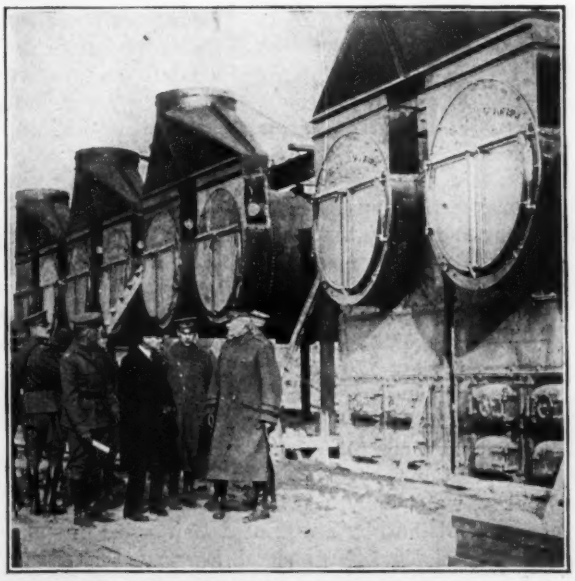


FIG. 9. SECRETARY BAKER AND GENERAL PERSHING IN FRONT OF BOILERS OF REFRIGERATING PLANT

being formed with a road grader hauled by a caterpillar tractor (Fig. 7). The method is to make two cuts, one on either side of the center line, thus forming ditches, and at the same time throwing the material into subgrade where it is levelled off by hand prior to the placing of the ties. A certain amount of road building is required at the intermediate depot. One of the views in Fig. 7 shows a gasoline roller which was put to work as soon as it had been received from the United States.

One of the features of the intermediate depot is the big refrigerating and ice-making plant which has been in operation since May 2. It serves as a cold-storage house for meat and other perishable products required

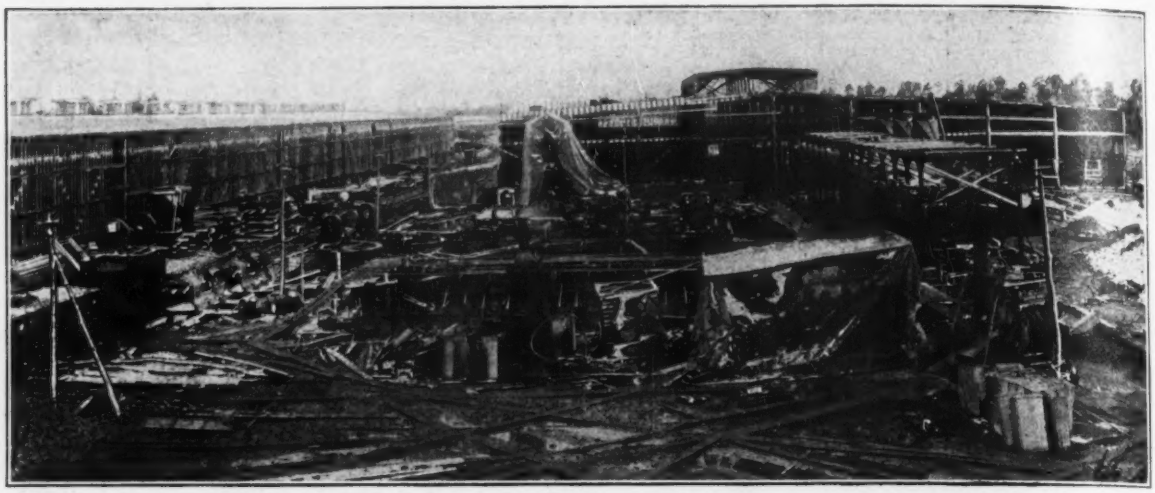


FIG. 10. REFRIGERATING PLANT UNDER CONSTRUCTION LAST WINTER

by the Army, and was designed originally to have a capacity of 5000 tons of frozen meat at a temperature of 12° F., in addition to the production of 500 tons of ice daily. The first plans have been altered to some extent as regards the temperature in the cold-storage rooms. In order to obviate the necessity of icing the railway cars in which the meat is transported from the refrigerating plant to the front, a lower temperature than that originally contemplated is being maintained in the cold-storage rooms. During my visit to the plant the thermometer indicated 1° below zero. By maintaining this zero temperature—which is the present operating practice—meat can be delivered to points of consumption without the use of iced cars.

The refrigerating plant consists of a group of 12 principal buildings, some of which are of the following sizes: beef storage, 112 x 896 ft.; ice-making, 100 x 218 ft.; ice storage, 68 x 218 ft.; engine room, 60 x 170 ft.; boiler room, 53 x 170 ft.; pump room, 25 x 38 ft.; machine shop and store room, 64 x 96 ft.; laundry, 24 x 50 ft. In addition there are a few miscellaneous buildings and a concrete reservoir 65 x 65 ft. in plan. For its operation the refrigerating plant requires 4,000,000 gal. of water daily, which is obtained from a river ⅝ of a mile distant, by means of a 16-in. pipe line and a pumping station. A general layout is shown in Fig. 8.

The engine, boiler and pump-room equipment includes eight 225-hp. boilers (Fig. 9), four refrigerating machines with a total capacity of 1100 tons refrigeration, equivalent to the cooling effect obtained from the melting of 1100 tons of ice daily. There are two 150 kva. electric generators and three turbine-driven centrifugal pumps, each with a capacity of 1800 gal. per minute, or a total capacity of 5400 gal. per minute.

Refrigeration is by direct expansion of ammonia circulating in coils hung from the ceiling of the refrigerator building, which is divided into five rooms, each with a capacity of about 1000 tons of meat. Means are also provided for storing vegetables and other products at a somewhat higher temperature than the zero degrees maintained in the meat-storage rooms. As an indication of the immense size of this plant, it may be noted that for the refrigerating coils alone 30 miles of 2-in. pipe were required.

While the original plans for the manufacture of ice, as distinguished from the provision of refrigeration in the meat-storage rooms, have been modified for a smaller output, the plant is nevertheless equipped to produce ice. In the ice-making building, there are six freezing tanks, each with a capacity of 62½ tons of ice daily. The freezing tanks contain a solution of brine cooled by 26 miles of 1¼-in. iron pipe.

Into the construction of the refrigerating plant 4,000,000 ft. b.m. of lumber, equivalent to about 6000 tons, have entered. Insulation for the cold-storage rooms, roofing paper, insulating paper, and brick for boiler settings, represented a tonnage of 2600, while 2000 tons is the weight of the mechanical equipment for the plant. Then, too, there are items of 400 tons of salt and 200 tons of ammonia, including the weight of the drums in which it is shipped. Summing up, the refrigerating plant represents a tonnage of 11,200. This figure is important when it is recalled that practically everything which entered into the construction of the plant had to be shipped from the United States. In addition, concrete for footings, walls, engine foundations, etc., was required, most of the cement for this purpose having been obtained from Europe. Exclusive of the cost of transportation from the United States—itself an item of no mean size under present conditions—the refrigerating plant represents an outlay of more than $2,000,000.

Obviously, such work as that required for the installation of a large plant of this kind could have been handled only by specialists. This fact was appreciated last year, and while the designs were being prepared at Washington there was organized a so-called ice plant company of engineers of about 350 men, most of whom were recruited from the personnel of the large packing companies of the Middle West. Actual work on the refrigerating plant was started in France in December, 1917, but the promise by those in charge of the installation that operation could be begun in five months was regarded with skepticism in some quarters. Never-

theless, in spite of all the difficulties which surround construction work in France these days, this promise was fulfilled ahead of schedule, and the placing of the works in operation on May 2 of this year is a splendid tribute to the men of the ice plant company.

In explaining to me the plans for the refrigerating plant, which were prepared under the direction of the cantonment division of the Quartermaster Department —now known as the construction division—a major of the Quartermaster Corps who is an expert on refrigeration mentioned a few of the outstanding features of the design. Great pains have been taken to insure flexibility in the layout of the piping. A break would be serious, especially over here where ammonia losses cannot be so easily replaced as in the United States. Horizontal return-tube boilers were selected on the grounds of ease of installation and ease of shipment. On the liquid ammonia lines ample provision is made for expansion and—a very important point—these lines are sectionalized by the introduction of valves at frequent points; in case of a break a section of piping may be at once cut out of the system and ammonia losses thereby greatly reduced.

Provision is made for the use of exhaust steam for distilled-water ice which may be needed for special purposes, as, for example, in hospitals. In the manufacture of ice which, in the case of the plant at the intermediate depot, is accomplished by suspending cans of water in a brine solution, the impurities in the water are forced toward the center of the block as the freezing operation progresses from the outside inward. To offset this trouble pipe lines are introduced which, when the block is partially frozen, suck out the impure water at the core, and replace it with clean water. A clear block of ice is the result.

By maintaining a zero temperature in the freezing rooms, and allowing meat to remain there four days before shipment, it will be possible to dispense with special refrigerating cars and to forward the frozen meat in plain box-cars. This feature of the plant operation is an exceedingly important one in view of the present car shortage in France and the undesirability of introducing special cars for special purposes.

Provision is also made in the operation of the plant for salvaging oil. Judged by many other engineering structures which have been built by our engineers in France, the plant occupies an almost unique position. I was told that it had been built exactly in accordance with the drawings.

A view of the refrigerating building (Fig. 11) from the roof of the ammonia condenser shows that the feature of our plant, so far as the layout of this building is concerned, is the use of a long, low, single-story structure, rather than a more compact building of several stories as is common elsewhere. The advantage of the layout adopted is that long trains can be quickly loaded and unloaded. The main refrigerating building, measuring 896 x 112 ft., will accommodate 25 freight cars on each side.

The successful completion of the refrigerating plant is due in no small measure to the precautions taken in America in the crating, marking and shipping of the multitude of mechanical parts required. At Washington the delivery of the material ready for shipment abroad was controlled by charts, and shipments were well coördinated, and as a result the machinery arrived in France when and as needed—a most remarkable performance when one considers the unprecedented volume of transatlantic freight now being carried and the difficulties involved in avoiding mistakes and delays.

Photograph by Engineering News-Record

FIG. 11. HOW CARS ARE HANDLED AT THE BEEF STORAGE BUILDING

May Acquire Utilities by Condemnation

A decision was recently handed down by the supreme court of the State of California upholding the Railroad Commission and sustaining the right of a municipality to condemn public utility properties. The suit was entered by the Marin Water & Power Co. and the North Coast Water Co. against the Marin Municipal Water District after the Railroad Commission had passed upon the matter in 1915. The supreme court holds that it was bound by law to take the valuation put on the properties by the Railroad Commission; that the company was not entitled to any increase in value accruing after the assessment of the property and prior to the completion of the transaction, and that the law under which the condemnation proceedings were brought was constitutional. The decision of the commission, now confirmed by the court, authorized the district to take over the properties on a payment of $1,200,500 to the Marin Water & Power Co. and $289,200 to the North Coast Water Company.

This case has been followed with great interest by other water districts because it is the first to be fought out since the passage of the California law putting under the jurisdiction of the Railroad Commission the condemnation of public utilities. This decision is taken to mean that there may be no appeal on the question of valuation as set by the Railroad Commission, although a case may be taken into higher courts on other grounds.

Engineering Methods Solve New Haven's Man-Power Problem

Tap New Sources of Local Supply by Organized Publicity—Attract 247 Women a Week, 54 Per Cent. Increase, to War Factories

By Charlton L. Edholm
Executive Secretary, Committee on Man-Power Engineering, National Americanization Committee, New York City

APPEALS to the American spirit of the citizens of New Haven, Conn., proved successful in increasing the supply of war workers after engineering analysis of the situation had shown that the only unexhausted source of new labor was to be found among residents who could change their occupation or put forth extra efforts, in addition to discharging home duties, for the purpose of increasing the country's supply of munitions. The immediate response increased the weekly supply of new women workers by first 50, then 100 per cent.

The men who direct the big plants of that city canvassed the various sources of labor supply, when the draft threatened to deplete their factories, and found that there were six, namely: (1) to transfer workers from an essential industry in another community, or, (2) from the same community; (3) to transfer from a nonessential industry in another community, or, (4) from the same community; (5) the employment of idlers, who were designated "industrial slackers" and included well-to-do shirkers as well as vagrants, and (6) the development of latent industrial forces within the community.

It was recognized that the transfer of labor from one essential industry to another was merely movement in a circle and could produce no good results. The transfer from nonessential industries was made difficult by the fact that in many cases it is impossible to determine just which industries are nonessential. Some goods that are regarded as luxuries serve a valuable purpose, when the question is analyzed, and luxuries designed for export are especially "essential" in maintaining a favorable trade balance and thus protecting the nation's gold reserve.

There remained the employment of the industrial slacker and the development of the latent forces within the community, and it was upon these sources that the employers decided to draw.

A publicity campaign was undertaken through the newspapers and a number of meetings were held, some of them by women's clubs and some for the general public. It was found by investigation among the women's clubs that a large number of girls and young women were available for certain kinds of work in the factories requiring quick wits and nimble fingers rather than great muscular strength. The tending of machines and feeding them with raw material, inspecting, finishing and various other processes, could be handled by women as well as by men, if not better.

But the difficulty was to overcome the class prejudice that kept these women out of factories. The patriotic appeal was brought out in the newspaper advertising, and of the series of half-page displays that were carried the circular shown at the top of the next column is typical.

The press coöperated with much free publicity, giving space to articles describing the efforts made by French and English women to sustain their governments by work in the munitions plants. Editorials were printed along the same lines. Through the women's clubs, the seal of social approval was set upon this movement, and in New Haven it became the correct thing to engage in war work, including industrial employment.

A centrally located bureau was established, where volunteers could enroll for work in factories, and women's organizations were canvassed to secure names. Thousands of women signified their desire to enter factories, either munitions works or others.

Prior to the inauguration of this campaign the Winchester Repeating Arms Co. had been obtaining about 160 new women workers a week. During the first two weeks this average was increased 50 per cent., while for the first four weeks an increase of 100 per cent. was netted. From this point on, the gain in the company's plant was less spectacular, dropping to an average of 54 per cent., more because the demand for workers had been filled than for lack of applicants. A large number applying to this plant and distributed to other war industries is not included in these figures.

The wages offered to women were the same as those offered to men for similar work, and care was taken to protect the women factory workers from injury, excessive fatigue and undue discomfort.

It was found that many women were available for only part-time work, so the plan was adopted of pairing, one woman agreeing to work in the forenoon and the other in the afternoon. This arrangement was sometimes extended to allow neighbors who "paired" to take

TO THE WOMEN OF NEW HAVEN!

New Haven needs your individual help for national service.

The United States Government has called upon the manufacturers of New Haven to furnish immense quantities of a great variety of products. A large number of industrial workers are needed for this purpose.

The industrial work of New Haven, which is clean, honorable and well paid, offers an opportunity for national service.

The more people who work in a family, the less is the burden upon the individual. The more people who work in a community, the better is the distribution of the burden of support.

To decrease the number of the unproductive and increase the number of workers is a war measure that will both serve the Government and New Haven, offset the high cost of living, and stimulate business in general.

Many of the women in England and France who do not require their wages for support are investing their earnings in Government bonds or distributing them in wartime charities. New Haven is not far behind England in this respect. Already we have many women who are rendering unselfish service of this character. This is a double service, as they are not only giving their time to increase production, but are devoting their earnings to charitable and patriotic purposes.

Further information as to the opportunities to do industrial work can be obtained by applying to the Industrial Recruiting Station at 673 Chapel St.

THE EMPLOYERS OF NEW HAVEN.

over each other's home duties, so that while one woman was in the factory the other would look after the children and "keep an eye on the house" of the other.

In order to facilitate the patriotic impulse to work for the nation, the Winchester Repeating Arms Co. issues service flags and bronze badges for the munitions workers. The badge shows an American soldier charging, and in the background a huge munitions plant; it was designed by George T. Brewster, a sculptor of distinction. Each Winchester employee received a badge free. A service flag was issued to each employee and is designed for display in the window like the Red Cross service flag. It bears a reproduction of the badge, and the white field has space for stars, each representing a member of the household engaged in munitions work. Both men and women wear the badges with pride, and the windows of New Haven are bright with the service flags, showing the fine spirit that animates the industrial workers who are helping win the war by their daily toil.

There are two chief reasons why the New Haven plan is superior to the old competitive method of bidding for labor from other cities. In the first place, an influx of workers from the outside means a derangement of living conditions in the city. To obtain 10,000 workers, it would be necessary to absorb about 40,000 new inhabitants. The difficulty of obtaining housing for that number is a staggering problem in these war times, and the facilities of schools, street cars, railroads and all public service are taxed by the shifting of population. By developing the latent labor resources of the community all this waste is avoided.

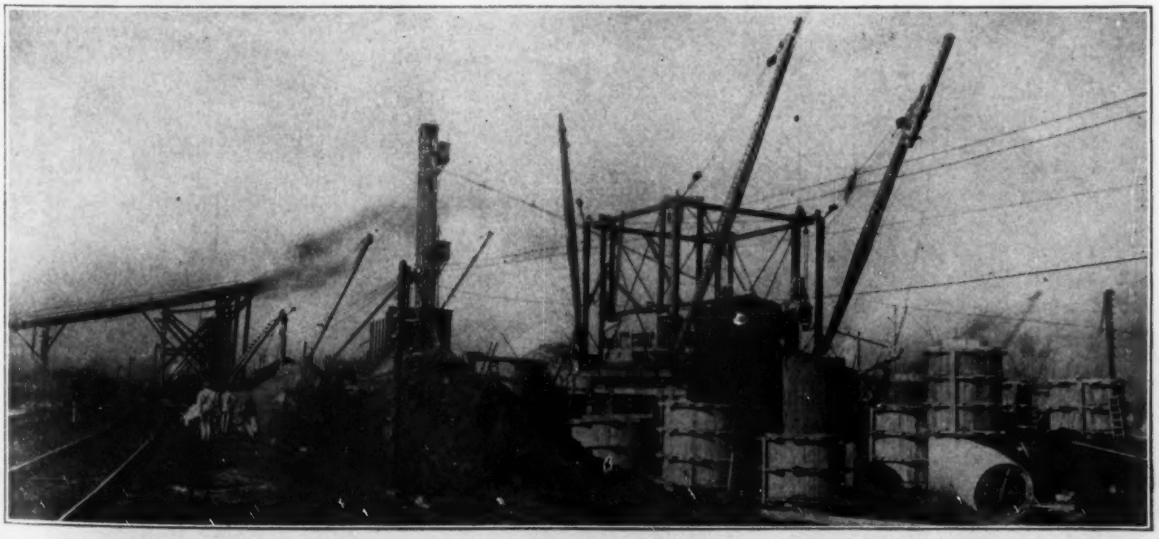
The second reason is that the use of women in industry is certain to increase with a long war. The time to get women accustomed to the idea is now, for the overcoming of prejudice is a long, slow task. The addition of thousands of skilled workers to American industries is going to be a big help in winning the war, and as long as women receive equal pay with men for the same service, there is no injustice to labor in employing them.

Discretion must be used in placing the women workers at tasks that are not too strenuous. Hours of labor, working conditions, living conditions and wages should be adjusted to make the industrial work attractive, profitable and safe for the newcomers. If it is entered into in a spirit of greed and labor exploitation, the employment of women will meet deserved opposition and will surely fail. If it is entered into in a spirit of genuine (not camouflaged) patriotism, it will be a mighty blow in the cause for which our soldiers are fighting.

Drop Shafts Sunk Through Buried Tree Trunks by Dredging

Tunnels, Foundation Piers and 82-Foot Wells Constructed by Sinking Concrete Caissons — Derricks and Aerial Chutes Handle 100,000 Yards of Foundation Materials for Large Kansas City Power Station

DERRICKS and overhead chute distribution of concrete overcame the obstacle of a railway embankment which ran directly across the construction site of the new power station for the Kansas City Light and Power Co. The chuting system provided an aërial line for handling of concrete, and the derricks, by lifting and passing loads from one to another, eliminated the necessity of surface tracks for handling other materials. It was possible also, by means of the derricks and overhead chutes, to skip over portions of the work obstructed by the embankment and return to these portions later when the obstruction had been removed. This satisfied a condition which made a pre-scheduled order of construction work impracticable.



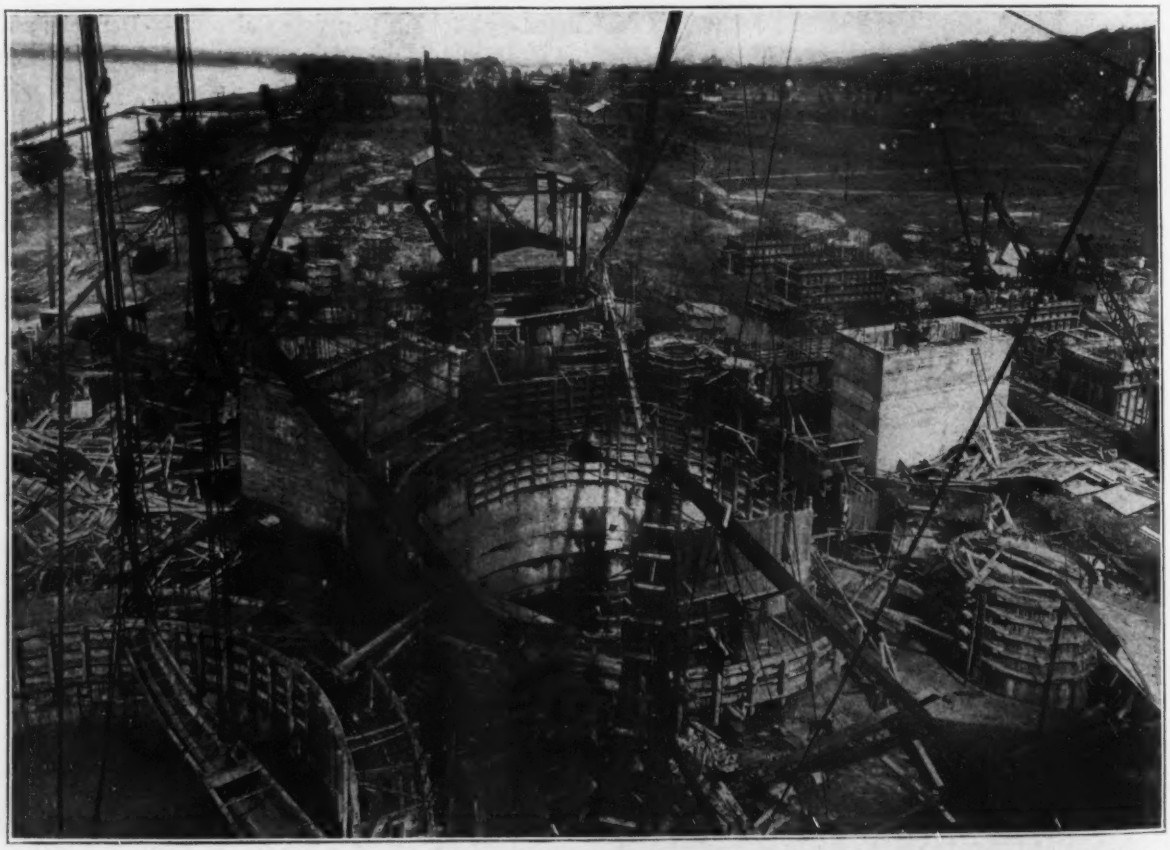
CENTRAL MIXING PLANT AND TOWER CHUTING FROM TWO HEIGHTS DISTRIBUTED CONCRETE OVER ENTIRE AREA—QUADRUPLE BOOM TRAVELING DERRICK CONSTRUCTED FOUR PIER CAISSONS AT ONCE

The foundations for the new station involved 50,000 cu.yd. of excavation and 45,000 cu.yd. of concrete work, distributed between two large diameter drop-shafts for intake and condenser wells, an intake tunnel, a discharge tunnel and numerous piers and footings. Construction plant and methods, therefore, had to be adapted to the execution of a number of independent, scattered pieces of work. Another complicating factor was a main-line double-track railway in operation on an 8-ft. embankment which ran directly across the construction site. This railway embankment covered part of the work planned and interposed an effectual surface barrier between the other two parts. Removal of the railway was of course planned, but when work on the foundations was commenced the date of removal was undetermined. Indeed, time passed, and several dates for removal were set and then postponed. When, finally, the embankment was out of the way, foundation construction was well advanced.

No inter-job surface track system was possible so long as the railway remained in service. Also, it was not practicable to pre-schedule the order of construction, because until the railway was removed portions of the site were inaccessible, and work here had to be postponed and undertaken as occasion offered. The logical plan, for example, would have been to commence the boiler-house foundations early, but as the railway embankment covered the sites for these foundations access was prevented until quite late in the construction schedule. Plant selection and layout had, therefore, to provide inter-job transportation without surface roads, and to permit of shifting construction operations as conditions required.

Excavation and concrete placing constituted the bulk of the construction work. The governing operation was excavation, comprised largely in the two large wells and their tunnel connections to the river, but also scattered among many separate wells for piers and pits for footings. The use of derricks and cranes promised the best solution of the excavation-plant problem, under the conditions. They required no means outside themselves for inter-job handling of materials; they could be shifted as the order of construction changed; they could be operated one at a time or in any combination of numbers. Also, as the material excavated could be consumed in a required raising of the ground level at the construction site, derricks met well enough the problem of spoil disposal. In the matter of placing concrete the conditions of scattered and frequently shifting points of disposal were perfectly met by the use of a central mixing plant with a tower and chute distribution.

For depths of 10 to 15 ft. the site was made ground, consisting of loam, silt and various decomposed vegetable matters in small quantities. Below this top layer to another 20 ft. in depth was fine sand, which changed into coarse sand and a fine gravel. This gravel layer was made the foundation bed for all the principal foundation structures. Two conditions complicated the excavation problem. The sand stratum contained many



DOUBLE-TRACK MAIN LINE, BISECTING JOB AND NOT REMOVED TILL LATE IN WORK, CONDITIONED LAYOUT

TUNNEL FORMS READY FOR CONCRETE AT THE BOTTOM OF THE BIG CONDENSER WELL

large tree trunks which had to be cut and dug out. Also, depending on the stage of the river, some 25 to 30 ft. of the work was below water level.

Drop-shaft methods, as employed on this work, are represented by the sinking of the 82-ft. diameter shafts for the intake and condenser wells. A pit some seven or eight feet deep down to about water level was excavated with a derrick and clamshell and brought to a level around the edges for setting up the steel cutting edge, the cutting edge forms, and the first lift of the shell forms. After these forms were filled the second lift of the shell forms was set and concreted. Sinking was then begun by excavating inside with derrick and clamshell. As the caisson sank the shell was built up by placing and concreting successive tiers of forms. When the cutting edge reached the required depth the bottom of the pit was dished, and a concrete seal was placed, using submarine concrete buckets handled by derricks. After the seal had set the well was pumped out and all the other work was done in the dry. Exactly similar methods were followed in sinking the small wells for piers.

The tunnels were constructed by sinking end to end a series of rectangular concrete caissons. Each caisson was sunk by methods similar to those used in sinking the wells. The caissons, however, had temporary bulkhead ends, so that after they were sunk connection could be made from one to the other. In making a connection sheet piles were driven on each side to close the ends of the space between the caissons, and the earth between was removed by derrick and clamshell; the bottom was then sealed, the bulkheads were removed and the walls were concreted. The tops of the tunnels were then put in place.

Two portions of the work, the river ends of the tunnels, being under water, required different methods. Here crib caissons of 12 x 12-in. timbers were floated into position and gradually sunk by excavating inside and building up the walls. When down to grade the concrete seal was placed and the crib was pumped out. The remainder of the concreting was done in the dry.

Excavation was the governing operation. Efforts, therefore, were concentrated on making the greatest progress possible in this task. A plant of 12 derricks and a locomotive crane was employed. These operated clamshell and orangepeel buckets and handled the sectional forms. Most of the derricks were stiff-legs operated by three-drum engines and separated swinging engines. For sinking groups of small piers effective use was made of a four-boom traveling derrick, each boom operated by a two-drum hoist and a separate swinging engine and counterweight. The four booms of this derrick would handle the work for four piers at one time.

Difficulties in excavation were confined largely to the removal of the buried tree trunks. Where these obstructions occurred in the larger pits and were clear of the caisson cutting edges, excavation was made around them and they were lifted out by the clamshells. With practice, the clamshell operators become very

skillful in searching out under water and in getting a lifting hold on these logs. In one case the operator took out in one piece a log 51 ft. long which was encountered 30 ft. deep in the intake well. A curious find was a length of 14-in. cast-iron pipe buried 25 ft. deep. The difficulties of log removal were greater in the small wells, as here the obstructions came under the cutting edges of the caissons and had to be broken up. Sometimes a sharpened railway rail churned up and down endwise by a derrick would cut and split the log into fragments, which could be dredged out by the clamshell. In more difficult cases a diver was sent down to place a blast which broke up the timber. Often a chain hitched around the end by the diver made possible the snaking out of the log with a derrick.

Disposal of the excavation was generally a simple task. The original ground level of the site was 10 ft. lower than the planned finished level, so that a large part of the excavation could be handled quite directly into fill. Sluiceways were employed in two instances to handle the spoil to fills a little distance away, and in one case across the railway tracks. The sluices were carried on trestle inclines and had at the upper end a tray into which the clamshell dumped. A pipe line and a hose nozzle washed the dirt from the tray down the chute to the place of fill, where it spread out over the ground.

Concrete for sealing the caissons was placed by derricks and submarine buckets. All the concrete was chuted to place from a timber tower 133 ft. high at the central mixing plant. This mixing plant had overhead sand and stone bins feeding two 1-cu.yd. mixers. Stone and sand delivered by railway were unloaded by clamshell into the bins or, when the bins were full, into stockpiles. Cement was stored in a house at the rear of the bins. From the cement house sacks were taken to the mixers on a push car hauled by a small hoisting engine. Two tower delivery hoppers, one about midheight for chuting to nearby work, and one near the top for reaching more distant work, were used.

Forms were generally built in panels which could be assembled and used repeatedly. The lumber for these was prepared largely in a field sawmill. A machine shop with a forge, an emery wheel, a lathe, a drill press and pipe cutting and threading machines completed the field shop equipment.

Open caisson work as a general construction method for subsurface structures of various kinds is the outstanding construction engineering feature of the work described. Caisson methods were employed for the great 82-ft. intake and condenser wells and for the small 8 to 15-ft. piers for columns, and they were employed for several hundred feet of tunnel construction, for work started in the open air and on the river bottom. Similar large diameter wells were constructed, however, for the power station for the Union Gas and Electric Co., Cincinnati, Ohio, by the same firm. The work was described in *Engineering News-Record* of Sept. 27, 1917, p. 593. At Kansas City, as at Cincinnati a year ago, difficulty expected in keeping the big cylinders level and on center was not realized. Care had to be exercised, but no serious trouble was experienced. Allowance was made in planning the work for a reasonable off-center shift, but the full allowance was never taken up.

The power plant was designed by Sargent & Lundy, Chicago, consulting engineers. The contractor was the Foundation Co., and the contract was handled by this company's Chicago office, of which Frederick W. Adgate is manager. G. B. Mitchell was superintendent of construction for the contractors.

Commerce Commission Makes First Final Valuation Report in Texas Midland Case

Gives No Single Final Value, but Will Later—Shows No Reproduction Cost of Land, but Lists Present Value Separately—Deducts Depreciation, Disallows "Other Values," Appreciation, Contingencies

RULINGS that may be interpreted as establishing general principles are made by the Interstate Commerce Commission in its first final valuation, that of the Texas Midland R.R., the report on which has just been made public. No single sum is indicated as final value. The commission interprets the valuation act as authorizing it to find such a sum and it will do so in due course, the facts meanwhile being available. In most respects the commission's findings accord with those of the Bureau of Valuation. There have been some upward adjustments of unit prices. No allowance, however, is made for "other values or elements of value," for appreciation, for materials and supplies, for working capital or for contingencies, while accrued depreciation is deducted in accordance with the bureau's interpretation. Property used by the Texas Midland but owned by other carriers is listed only, the cost figures to be included only in the inventories of the carrier companies. Industrial tracks and their rights-of-way are allowed only on the basis of actual ownership. No attempt is made to show the reproduction cost of land; the present value is listed separately, and is not included in the reproduction-cost totals for the property. The allowances for engineering and for general expenses other than interest during construction are 2¼ and 1½%, respectively. A statement of original cost, not given in the tentative valuation, is included in the final report.

The original cost, including $67,493.44 for land, is given as $2,892,361. Exclusive of land, the totals for reproduction cost new and reproduction cost less depreciation are respectively $3,461,356 and $2,597,442, each of the latter two figures being about 2½% higher than the corresponding figures in the tentative valuation. (See *Engineering Record* of Nov. 11, 1916, p. 598.) The differences are due to the substitution of higher unit prices for certain tie, ballast and tracklaying items, the admission of telegraph and telephone lines excluded from the tentative valuation, and slight revisions of the allowances for engineering and for general expenditures. The present value of the company's land is given as $254,479.98, which, added to the repro-

duction totals would bring them up to $3,715,836 and $2,851,922, respectively. Compared with these figures, the capitalization is $2,112,000.

Single Sum for Final Value

Regarding the much discussed question of whether or not the valuation act requires the finding of a single sum as the value of the property, the commission states that it is of the opinion that it authorizes the finding of such value, and the commission intends ultimately to make such finding as to each property. "Under the circumstances of the instant case," states the report, "full justice will be done if the findings made as to underlying facts stand, with leave to the carrier and other parties to apply to be heard upon the undetermined question as to what sum shall be stated."

In the tentative valuation it was stated that original cost could not be found. Figures purporting to show original cost of equipment and land were, however, reported, and the commission has found that from the tentative valuation it is possible to ascertain the amount of money which has been expended on the property as accurately as the records of the carrier permit. The figure given in this case is asserted by the commission to represent "within reasonably close limits of accuracy the maximum amount of money which the carrier, its predecessor or any other person or persons invested in the property."

Realizing that original cost to date is in many cases difficult to ascertain, the commission says: "Original cost to date will be reported as fully as it can be ascertained from the best evidence which is practically available . . . If it is not possible to show original cost to date for all of the carrier property, but it can be ascertained for a portion of the property, that fact will be reported . . . Whenever the original cost of the greater portion of the property can be ascertained, and as to minor parts cannot be ascertained from records, we shall within comparatively narrow limits estimate the original cost of such minor portions so as to show original cost of the whole property as closely as may be."

Conditions Assumed for Reproduction Cost

Cost of reproduction new is assumed by the commission to imply "that a railroad being operated is conceived of as nonexistent and then theoretically brought into existence by a succession of steps well known to competent engineers." Clearing and grubbing are not allowed except where forests now exist adjoining the right-of-way; in other words, present-day and not original topographic conditions are assumed. Historical conditions are assumed, however, with respect to materials used in construction; that is, reproduction new is interpreted to mean reproduction as built, so that where second-hand material was used second-hand material is figured.

Because assessments for public improvements are assumed to have carried their benefit with them through increased land values, no allowance is made for them except where they are so closely connected with the railroad that they would be wiped out if the railroad were removed.

Consideration has been given to the protest of the carrier in the matter of quantities and unit prices, and in some cases the carrier's contention has been allowed wholly or in part. For example, the unit price of 56c. for burnettized pine ties has been raised to the carrier's claim of 69c. A dollar a yard is allowed for burnt-clay ballast, as compared with 80c. in the tentative valuation and $1.60 claimed by the carrier. A figure of $900 per mile of road for tracklaying is substituted for the earlier figure of $780. No concession is made on the items of grading, bridges, trestles and culverts, and several smaller items of road and equipment. The carrier's contention, however, that allowance be made for telegraph and telephone lines on the right-of-way is sustained.

Contingencies and Engineering

Nothing is allowed for contingencies, except certain additions to the quantities of such items as spikes, to take care of wastage and other inevitable losses. The commission contends that while on a new road to be built contingencies will inevitably be encountered, the situation is different when the railroad has been built, and the engineer has it before his eyes.

The commission states that it arrived at its figure for engineering by both the synthetical and the historical method. A study was made of 121 railroad construction projects of all sizes, and the amount charged to engineers was found to vary from less than 1% to nearly 10%. The weighted average showed approximately 3.6%, in view of which the engineers were instructed to include an amount not less than 2% nor more than 5% of the investment in the road, exclusive of engineering and land. In the instant case the estimate was first made by the synthetical method, and 2.15% was the figure reached. The commission concluded that this represented a sufficient amount, but increased it slightly to take care of additions made to the tentative valuation.

General Expenditures

Asserting that a railroad with good credit has no difficulty during normal times in borrowing money at 4½%, the commission felt that the rate of 6% would be ample to cover all incidental items of expense during the construction period, as compared with 8% contended for by the carrier. "The construction period, as determined by our engineers," states the report, "does not represent the shortest period in which a railroad could be constructed, but rather that period within which the work might be economically done." Considering that the carrier is crossed by several different roads, the commission believes that in this as in other instances the period allowed for reproduction would be materially less than originally required for construction. As to the proper interest period, the commission assumes that a railroad company would have a sufficient amount of money on hand at the beginning of each six months to cover construction expenditures for that period. It states also that a study of the construction of certain roads shows that when expenditures begin they continue at about an even rate to the end of the construction period. The assumption is therefore made that the time for which interest should be allowed

is one-half the construction period, plus three months. An allowance of three months is made for money expended for equipment.

As to all general expenditures other than interest during construction, the commission believes a percentage method to be preferable to the synthetical method used by the member of the engineering board. A study of general expenditures for the same 121 railroad projects previously referred to indicated an average of 1.93% of all road accounts, exclusive of land. A figure almost identical, 1.889%, was found for the Virginian Ry., which the bureau thought was illustrative. After careful deliberation, the bureau concluded that 1½% was a proper allowance, and the commission agrees with this figure. The total of $40,064 allowed compares with $31,091 in the tentative valuation and $146,650 claimed by the carrier.

Both materials and supplies and cash on hand, while inventoried in the accounting report, are excluded from the final valuation. The commission differentiates between the plant itself and its operating assets. "By the plant," it states, "is meant the roadway, equipment and other physical parts. Operating assets include materials and supplies and cash on hand. . . . In cost of reproduction new the property to be theoretically reproduced is the railroad itself. It does not contemplate inclusion of materials and supplies and cash on hand, which are so-called liquid assets, and change from day to day."

Only Present Value of Land

The contention of the carrier with respect to land is rejected. Acknowledging testimony that in the acquisition of a railroad right-of-way a carrier must pay more than the market value for its land, the commission perceives "a marked difference between assuming in advance the total cost of acquisition, whether as the result of condemnation and damages paid or of purchase, in excess of the present value of similar lands in the vicinity, when no railroad has been constructed or is in operation, and the attempt to ascertain and state the cost of reproducing or reacquiring, at the present time, lands which actually have been severed from the adjacent property, have been converted into a railroad and are being occupied by an operating rail carrier." The commission finds itself unable to see any difference between the theory advocated by the carrier and that rejected by the Supreme Court in the Minnesota rate cases. "Before we can report figures as ascertained," it states, "we must have a reasonable foundation for our estimate, and when, as here, the estimate can be made only upon assumptions, and upon impossible hypotheses, such as those pointed out by the Supreme Court in the opinion quoted, our duty to abstain from reporting as an ascertained fact that which is incapable of rational ascertainment is clear."

As an added reason for rejecting the carrier's theory in this case, the commission feels that there is no certainty as to what land the carrier would have to pay for in case of reproduction. The railroad, it says, was built comparatively recently, and more than 25% of its right-of-way was donated. Nothing in the records shows the commission that reproduction of the road would be regarded in any less friendly spirit by the community as a whole and individual owners in particular than when the right-of-way and terminals in question were acquired but a few years ago. The commission does not feel, therefore, that all such donated lands would necessarily have to be bought or condemned and paid for at the full amount which a jury would award on condemnation.

In the matter of streets and highways occupied, the commission holds that such occupation should be regarded as franchise rights, and not as acreage owned. It would allow the carrier for streets or alleys vacated as such and used exclusively for common-carrier purposes, but not for streets or alleys used jointly by the public and the carrier. Outside of a municipality land jointly used by public and carrier would be allowed the carrier unless it affirmatively appeared that the carrier did not own it.

Depreciation, Appreciation and "Other Values"

In the case of depreciation, also, the contention of the carrier is disallowed. The commission holds that at the time the valuation act was passed depreciation was understood to rest entirely on the basis of service life spent and remaining, and not at all on that of efficiency of present use. The commission holds, further, that this definition is supported by the courts and doubts whether any case can be found where it has been deliberately assumed that depreciation and deferred maintenance were synonymous.

Appreciation is disallowed by the commission. The valuation act, the commission states, nowhere refers to appreciation, which it regards as the antithesis of depreciation, but which it states cannot be estimated as depreciation can. Conceding that certain items of maintenance are higher on a new railroad than on an older one, it believes that others, such as tie renewals, are lower, and "that the net result seems to be that the total cost of maintenance during the early years is less than afterward." Furthermore, "the attempt to measure the value of appreciation by its cost," the commission says, "is not consistent with our prescribed rules of accounting, under which the expenses of operation are chargeable to operation." The conclusion, therefore, is that no separate value can be placed upon appreciation.

No "other values or elements of value" are reported. None were reported in the tentative valuation, and the carrier asserted that the valuation act had not been complied with. Invited to put in testimony as to such other values, the carrier did not, asserts the commission, offer any such testimony. The commission holds that no substantial evidence of other values has been presented to it. Conceding that going value, described as "the value of an assembled and established plant doing business over one not thus advanced," is recognized by the decision in the Des Moines gas case, the commission asserts that "there has been urged upon us a going value which is said to exist in addition to that here referred to, which apparently runs into sums of great magnitude, but which, in spite of its magnitude, is incapable of more than the most metaphysical and conjectural description on the part of those who advocate its inclusion as an element of value. It has been urged upon us on many successive occasions, but from the beginning it has been nothing but a vague claim."

Sixty-One-Foot Hydraulic-Fill Dam Rests on Earth Foundation

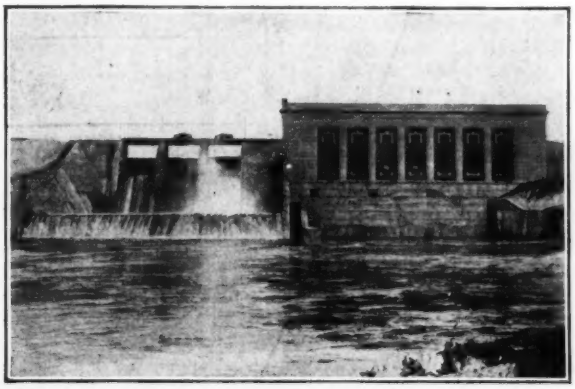
Junction Hydro-Electric Development in Southern Michigan Notable for Winter Placing of Earth Fill and for Extreme Height of Concrete Retaining Walls, Which Hold 90 Feet of Fill

By William G. Fargo
Fargo Engineering Co., Jackson, Mich.

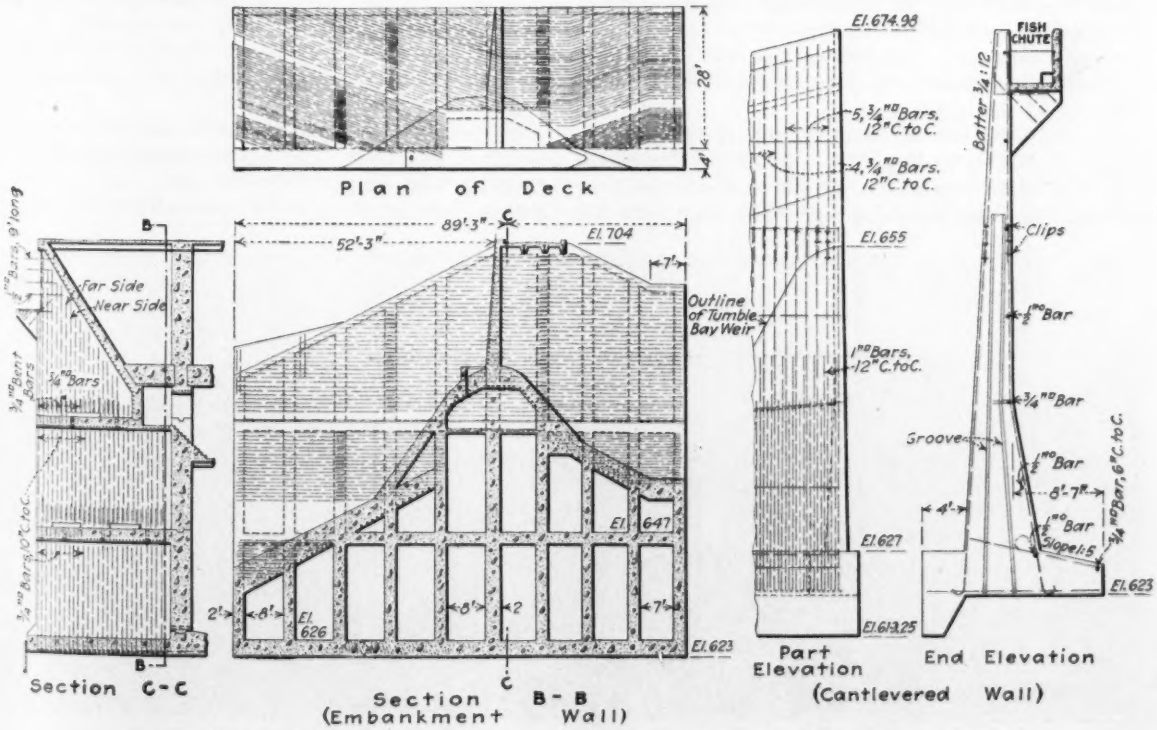
AN EARTH-FILL dam 61 ft. high, founded on clay hardpan and built by the sluicing process through an exceptionally severe winter, is the main structural feature of the new Junction development of the Consumers' Power Co. in southern Michigan. The earth fill, in addition, is retained at the side nearest the spillway by a reinforced-concrete retaining wall of a maximum height of 90 feet.

The new development is part of a chain of hydro-electric plants operated by the same company in the lower peninsula of Michigan. It is located 3½ miles from Wellston, on the Manistee River, about 25 miles above its mouth. The station has a total generating capacity of 16,500 kw. and is equipped with three single-runner vertical-type units, each rated at 5500 kw. at 90% power factor, speed being 100 r.p.m. The generators are three-phase, 30-cycle, 7500-volt machines. A new and independent 140,000-volt transmission line more than 100 miles long has been built to conduct the energy from this plant to Grand Rapids.

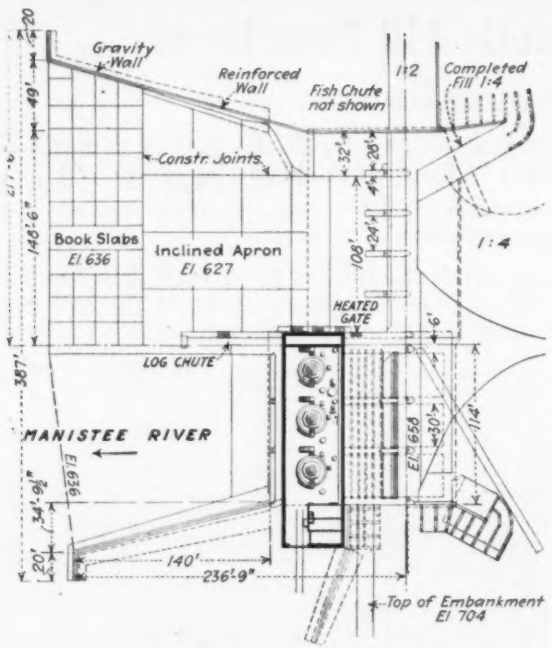
The site of this dam is in the heavy glacial drift region of the north central portion of the lower peninsula of Michigan. The nearest rock stratum is about 800 ft. below the river surface. A compact clay hardpan is found 15 to 30 ft. below the river surface at the site, and on this the dam and power house have been built. The owners and designing engineers of this development have within the past 14 years built seven other successful dams, with heads ranging from 26 to 40 ft. (three being 40 ft.) on the Au Sable, Muskegon and Grand Rivers in Michigan, placing the structures upon similar clay hardpan foundations. Where the hardpan is com-



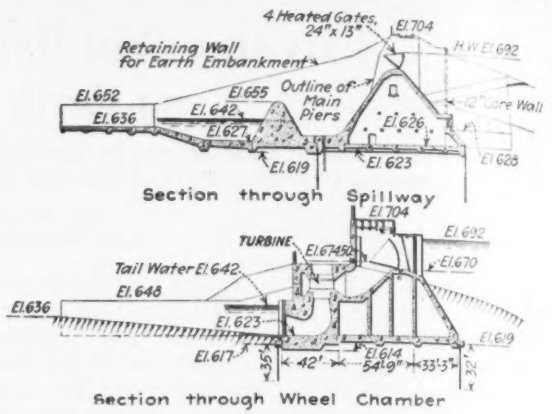
LOOKING UPSTREAM TOWARD POWER HOUSE AND SPILLWAY



REINFORCED-CONCRETE RETAINING WALL WHICH HOLDS FILL AWAY FROM SPILLWAY



DETAILS OF THE JUNCTION DAM AND HYDRO-ELECTRIC PLANT AT WELLSTON, MICHIGAN



pact and continuous no round or sheetpiling has been used. At Junction Dam a line of sheetpiling extends across the valley and to a depth of about 40 ft. below the normal river surface.

The drainage above Junction Dam is 1451 square miles. The Junction pond at El. 692 has an area of 1560 acres. This dam backs up the water in the main river about eight miles, and up the South Branch, which enters 1½ miles above the dam, a total distance of about 4½ miles to the Stronach development built in 1912 by the same owners. This development has 18-ft. head and was built primarily to furnish power for the construction of the larger dam.

The width of the valley at the top of the embankments, El. 704, is about 800 ft. On the south side the sand bluff rises to a height of 140 ft. above the river surface. The bank on the opposite side, into which the embankment is tied, is 76 ft. above the river surface. The power house and spillway are placed immediately in the old river channel, the river having been diverted during construction. These structures and the adjacent embankments form a straight line across the river valley and at right angles to its general direction. The power house adjoining the south bank is 145½ ft. in length and 40 ft. in width. Beyond this is the spillway, consisting of four 24 x 13-ft., steel tainter gates, motor-operated, surmounting a hollow concrete structure.

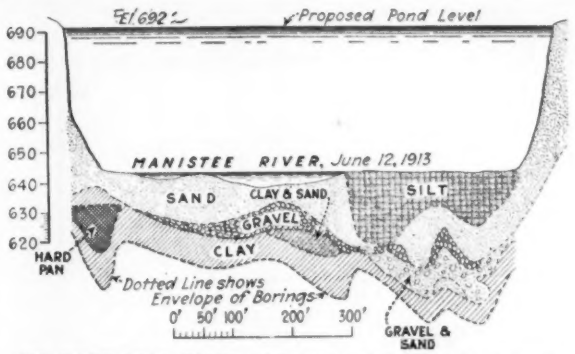
The ordinary flood is about 5000 c.f.s., and the maximum flood of record in the past 20 years is 7500 c.f.s. Two of these gates will, therefore, safely discharge the maximum flood of record without rise of headwater. The freeboard on the embankment is 12 ft., to provide for the possible failure of any future dam upstream.

Water passing through the tainter gates is received in a tumble bay 24 ft. deep bounded by a solid concrete weir of this height across the spilling channel, the crest of this weir being 13 ft. above tailwater. The spillway operates successfully to deliver the water at low velocity. In passing 5000 c.f.s. through the spillway, sand lies undisturbed on the last 50 ft. of concrete apron.

The principal embankment to the right of the spillway is 430 ft. long on top, and has a maximum height of 61 ft. in the land section. The top width is 12 ft.; the upstream slope beginning at the core wall is 1 on 4 and the

JUNCTION DAM UNDER CONSTRUCTION. SAND AND CLAY FILL BEING TAKEN FROM RIVER BANK AT RIGHT

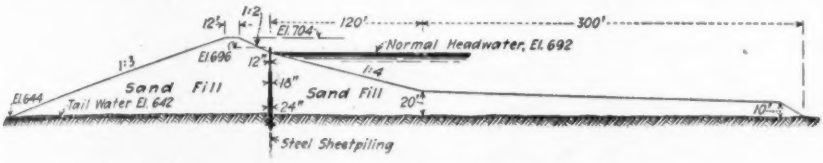
downstream slope 1 on 3. The total volume of the embankment and blanket fills is about 452,500 cu.yd. The south or left-hand embankment is a wedge 100 ft. long on top and zero at base. Both embankments have a reinforced-concrete core wall intersecting the upstream slope at the water line and carried 4 ft. above the normal head-water level. The core walls are 2 ft. thick in the lower section, 1½ ft. in the middle section, and 1 ft. thick in the top section. Underneath the core walls is a continuous line of steel sheetpiling driven to a general depth of 40 ft. below the tailwater level. Under the power-house section the hard clay is continuous and of considerable depth, but in the spillway section and northward are some sand seams, and under the north embankment the clay beds dip sharply to the north, so that sheetpiling was required to effect a tight cut-off. Since raising the headwater, the seepage from the north embankment has been collected and measured through a V-notch weir and has remained practically constant at 0.46 c.f.s., this seepage nearly all coming from the north bluff, where springs originally existed. This very satisfactory tightness of embankment is due to the character of the material of which the embankment is composed, to the manner of deposit by the hydraulic method,



NO ROCK WAS FOUND BELOW JUNCTION DAM SITE

and the care taken with the sheetpiling and core wall.

The embankment material was for the most part sluiced from the 140-ft. sand bluff on the south. This sand contained a small amount of fine gravel and thin seams of clay. By the hydraulic process this clay was rather intimately mixed with the sand, and although some of the clay by reason of its fineness was deposited in the toes of the embankment, for the most part it was mingled well with the sand, and accounts largely for the water-tightness of the embankment and blanket fills extending upstream a total distance of more than 400 ft.

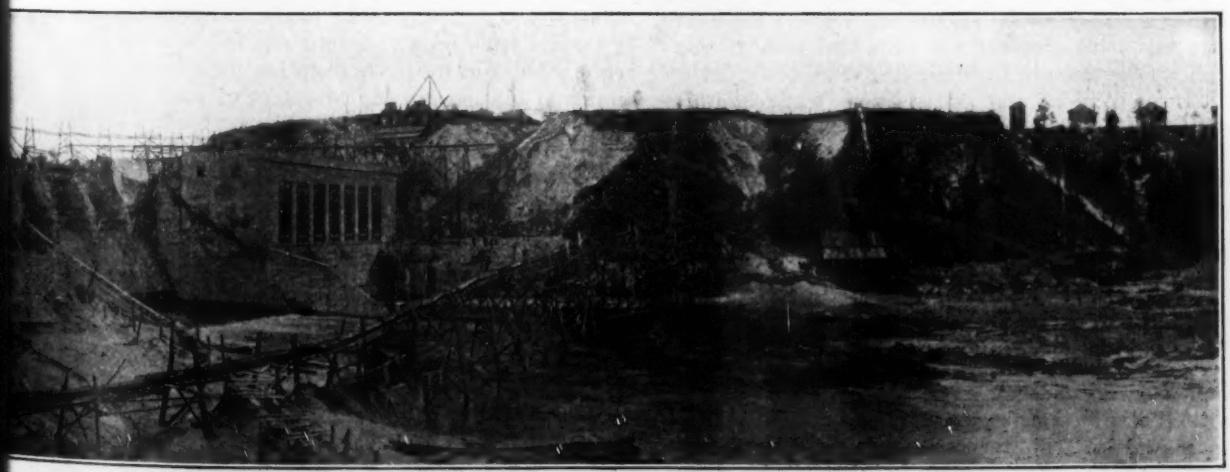


A THIN BLANKET FILL EXTENDED 300 FEET UPSTREAM OF EARTH DAM

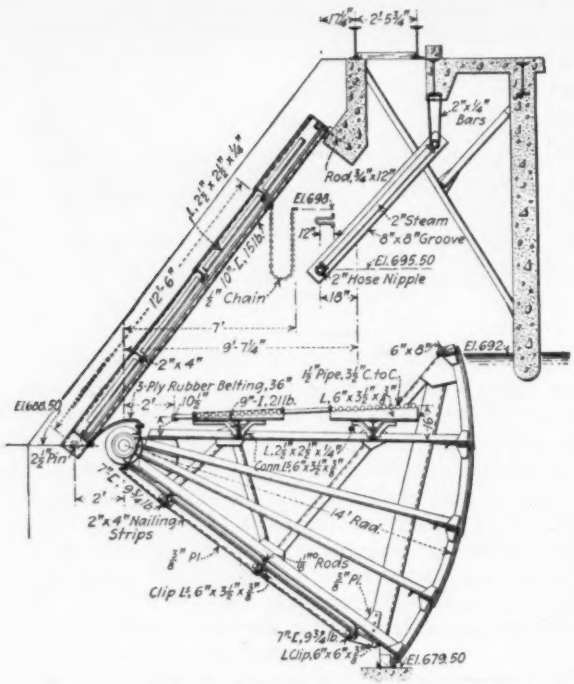
from the core wall. At a point 120 ft. upstream from the core wall the embankment is 20 to 25 ft. in thickness and the blanket fill in the next 300 ft. slopes down to a thickness of about 12 ft. A large part of this blanket fill was placed by ground sluicing, and it is consequently thicker at the sides of the valley. The areas covered by embankment contain but little muck or humus and, except to burn off the surface vegetation, brush and logs, no attempt was made to strip the embankment areas. In joining the embankments to the natural bluffs the slopes where necessary were stripped and stepped, but in general the bluffs were free from vegetation, and but little work of this kind was necessary.

Drains were laid downstream from the core wall at the foot of the bluffs on both sides of the river. Short lines of 4-in. tile were laid at intervals under the embankment toes and connected to a main intercepting drain. These drains are of socket pipe laid with loose joints and surrounded by gravel. Marsh hay was used to keep the fine sand out of the joints. The tile drains are performing their functions properly.

In designing the concrete construction of a multiple-unit power house the question of construction and contraction joints is a vital one. The joints must be so designed and constructed as to prevent leakage from



AND SLUICED INTO 61-FOOT EARTH DAM AT LEFT. SPILLWAY AND POWER HOUSE IN CENTER OF VIEW



TAINTER GATE IS HEATED FOR WINTER OPERATION

water, in this case under a total head at the wheelpit floor of 42 ft. Below this level the greater thickness of concrete and absence of necessary joints made the problem simpler, although the water was under a higher head. The construction joints in the penstocks have been made as few as possible, and where necessary have been made water-tight by specially bent copper, or corrugated ingot iron strips galvanized, these strips crossing the joints and permitting by their special corrugations movements at the joint. With sufficient care to prevent injury to the strips during construction this type of joint has proved quite satisfactory after use for a number of years in heads up to 60 ft. This type of joint is also used at intervals in the embankment core walls, and the water-tightness of these embankments is in a great measure due to the care taken with the joints.

Construction plans were prepared in detail to indicate exactly where joints were allowed, and no departure from this joint program was permitted without thorough consideration by the designing engineers. The result has been a very satisfactory water-tightness throughout the penstock and power-house section. The maximum length cast without joints was 114 ft. for the downstream wall of the three penstocks. Continuous pouring of concrete was practiced wherever necessary, and some of the runs took nearly a week, with stops at no time exceeding six hours.

The north embankment wall forming the spillway abutment was built as a cellular reinforced-concrete wall in the high part, where it had a maximum height in places of 90-ft. from base of foundation, and a 51-ft. maximum height for the cantilevered T-wall. In the high cellular section the top third was designed with a batter of 8½ in 12, to reduce the moment of earth pressure. All of the cells or pockets in this wall were sluiced full of sand.

The maximum soil pressure assumed at the toe of this wall was 7500 lb. per square foot. No piles were driven, as the foundation soil was a very tough and compact clay hardpan. Under full load for several months no settlement has occurred. The maximum soil pressure on the downstream side of penstocks is 8000 lb. per square foot. Test loads of 12,000 lb. per square foot of soil were supported without appreciable settlement.

Bracketed to the back of this retaining wall is a reinforced-concrete Cail fish chute on a slope approximately 1 on 4, the section of the chute being 4 ft. wide and 5 ft. high.

Aside from greater height, the spillway at Junction Dam differs in no essential feature from numerous similar spillways built in various parts of America. It has already been proved that in discharging the ordinary floods of the river the velocity on the downstream 50 ft. length of the concrete apron is sufficiently low not to disturb the sand lying on this part of the apron.

During that portion of the construction period after the spillway had been completed and while the main or north embankment was being placed, the river was diverted through temporary openings in this spillway, closed by wooden flap gates. There were eight of these gates, in size 12 x 10 ft., with their sills at El. 640, the actual size of the openings being 10 x 6 feet.

In the spillway section, 12 ft. in depth of sand and clay were sluiced through these temporary openings onto the floor of the dam to increase the weight and give greater stability. During the four-months' period when the river was being passed through these temporary openings, this sand fill inside the dam was covered with a plank floor which remained safely in place.

The severe winter conditions of this district require that one of the spillway gates be provided with a heating system so that in case of emergency there will be no delay in opening a gate. One of these gates will very nearly discharge the ordinary flood of the river. It is also found that when one of the gates has been opened and the water allowed to flow for a few hours the circulation thaws the ice on the remaining gates successively. The scheme of heating is to warm an inclosed chamber, between the gate piers, having such shape and size as to permit the opening of the gate within it. The radiators are supported on the upper radial struts of the gate and swing with it, the connection to the steam main being by a 2-in. flexible hose. Steam is supplied from the low-pressure boiler of the power plant heating system. This scheme of heating has the advantage of applying heat directly to the surface of the headwater about 2 ft. in width between the curtain wall and the gate itself. The details used would not be applicable to a dam at which the headwater was allowed to rise above a fixed elevation. The uniform flow of the Manistee River permits the operation of this plant with headwater maintained at a constant elevation of 692.

Each of the three wheel chambers is closed by a steel tainter headgate 30 ft. wide by 22 ft. vertical height. These headgates, like the spillway tainter gates, are hoisted directly by motor-driven worm-geared hoists without the aid of any counterweights. The headgates are trunnioned on 12-in. steel pins, each of which is stressed in bending with a load of 240,000 lb. The motor-driven hoists are operated from the power-house

switchboard, and tell-tales in sight of the operator indicate the position of the gate. The large size of these headgates permits the water to pass at a velocity of 2.57 ft. per second. The form of the water passages from racks to turbine is such that the water moves in very smoothly, and in making an efficiency test of the turbine, current meters were used very successfully as the range of velocities, both across the penstock and in each vertical, was quite uniform. The current meter section was taken 4 ft. downstream from the racks at the headwater level, the vertical being 10 ft. from the racks at the bottom.

The Consumers' Power Co., which owns Junction Dam, built it with its own forces and equipment. J. B. Foote, chief engineer of the company, was in general charge of the design and construction of this plant.

G. S. Cochran was general construction superintendent, and the resident superintendent was Fred B. Taylor.

George F. Stecker was in charge of the electrical design and construction. The hydraulic and structural design and engineering supervision of construction, except the electrical features, were in charge of the Fargo Engineering Co. of Jackson, Mich. H. N. Tuley was its resident engineer.

Construction Methods Used on the Junction Dam

Excavating, Concreting and Winter Earth Sluicing Features Requiring Careful Attention on Hydro-Electric Project

CONSTRUCTION through the winter months caused most of the problems in building the Junction Dam described in the preceding article, but the excavating and concreting methods have some further points of interest.

The main part of the excavation for the power house and spillway was located in the old river bed, and as a considerable part of the excavation was required in the blanket fill upstream from the dam, it was decided to make use of slack-line cableway excavators operating in an up- and down-stream direction. Two cableway excavators were provided, each of them having a wooden head mast 90 ft. high, located upstream from the area to be excavated. The main cables were of 1⅜-in. diameter and 600-ft. span and were anchored to concrete anchor blocks located downstream from the tailrace. Scraper buckets of 1½-cu.yd. capacity and of the rear gate discharge type were used. Each cableway was operated by one 10 x 12-in. two-drum hoisting engine. Excavated material was dumped around the wooden head masts, as shown in one of the accompanying photographs. These piles of earth were later sluiced into position to form a part of the upstream blanket fill. On account of a large number of sunken logs and old trees encountered in the excavation, which are clearly shown in the view, considerable difficulty was encountered in handling the excavated material, but it is probable that any other kind of excavating plant would have encountered the same difficulty.

Revolving drag-line excavators were used to excavate the diversion channel for turning the river during the construction period and also for other miscellaneous work.

All sand and gravel for concrete were obtained from a pit about five miles from the site of the dam, and were hauled from the pit in 6-yd. dump cars, the motive power being furnished by a two-motor electric work car.

The gravel was excavated at the pit by means of a drag-line excavator and was screened by means of rotary screens on top of a portable screening plant. The bank gravel contained a large amount of excess sand, which was disposed of behind the screening plant as it was moved along in the pit. The gravel and sand were dumped from the cars directly into storage bins of the concrete-mixing plant; the bins were placed near the top of the high bluff adjacent to the power house structure. Concrete mixers were used, one of 33 cu.ft. capacity and one of 28 cu.ft. capacity. Cement was purchased in cloth sacks which were piled in a cement storage house of 10,000 bbl. capacity.

All sand, gravel and cement were proportioned by weight, the cement being dumped from the sacks into a loose cement compartment above the mixers. This method of weighing, which was described in *Engineering News-Record* of Aug. 29, p. 393, gave excellent results and made it possible to change the proportions easily as occasion demanded.

Electric power was used for the screening and mixing plants and for operating all pumps. A transformer station was provided near the site of the power house and was served by a transmission line from Stronach dam. A motor generator set was used for providing the direct current required for the operation of the trolley line to the gravel pit.

CABLEWAY EXCAVATORS DIG FOUNDATIONS FOR SPILLWAY AND POWER HOUSE IN GROUND FULL OF LOGS

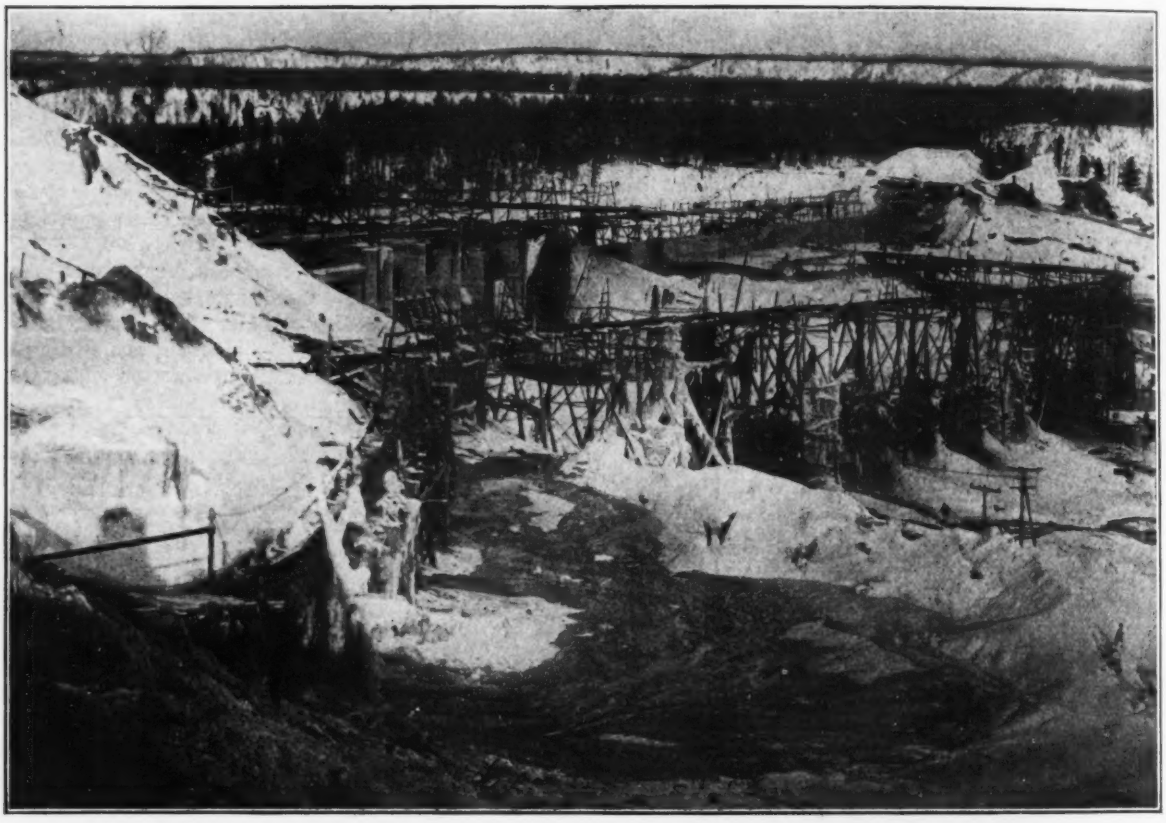
All freight was delivered on the Pere Marquette R.R. at a switch about three miles from the dam and was hauled to the site of the work by means of the trolley car.

No round piling was used on the job; but a large amount of steel sheet-piling was driven. Under the power house and spillway it was necessary to penetrate a layer of hard clay before reaching the sand, and in some places it was found impossible to drive the piling by ordinary means. A steam-operated channeling machine was used to good advantage in these places, a channel being cut in the hard clay to a depth of about

10 ft., and the steel piling was driven in this channel. Under the core wall the steel piling penetrated a number of veins of coarse gravel and also thin clay layers, and use was made of water jets operating under a pressure of about 100 lb. per square inch at the nozzle of the jet. It was found that if a ½-in. air pipe was introduced into the jet pipe, the combination of high-pressure air and water tended to displace the sand and gravel much more readily than by the use of water alone. A large amount of the steel piling was driven by means of double-acting steam hammers, but in some parts of the work it was found advisable to utilize drop-hammers.

In driving the steel piling through the clay under the power house and spillway, an artesian flow of water was encountered which forced its way to the surface along the line where the piling penetrated the clay. The piles were capped and the flow was stopped by grouting, as described in *Engineering News-Record* of July 18, p. 147.

Most of the earth was obtained from the high bluff near the power-house side of the dam, being transported to place in the earth embankment by means of sluicing troughs carried on wooden trestles. These sluicing troughs were for the most part made from No. 10-gage steel plates, and were approximately semicircular in shape, with a diameter of 30 in. The troughs were 10 ft. long and were so placed on the trestle that they overlapped each other a few inches. They are shown in two of the views. The sluicing grade was from 6% to 8%, and in ordinary weather no trouble from leakage was noted. However, in extremely cold weather it was found that there was a tendency for the slight back leakage through the joints between the troughs to form ice which gradually built up, lifting the lower end of each trough so that the effective sluicing grade was materially flattened. This made it necessary to remove the ice from the joints at frequent intervals, so that the sluiced material could be transported on the proper grade.



SLUICING EARTH INTO JUNCTION DAM DURING THE BELOW-ZERO WEATHER OF JANUARY, 1918

The greater part of the earth fill was made by means of the sluicing method, work being carried on throughout the extremely cold winter. The quantities of earth sluiced, with the temperatures during each of the winter months, are shown in the accompanying table:

	Cu.Yd. Sluiced	Temperature—Deg. Fahr. Maximum	Minimum	Average
1917:				
November	74,900	+68	+ 5	+35.8
December	98,000	+40	—18	+18.1
1918				
January	51,100	+26	—30	+ 8.6
February	48,300	+38	—29	+14.9
March	21,800	+50	— 6	+31.6

Centrifugal sluicing pumps were utilized, all of them being motor-driven. All the pumps were housed in, and no especial trouble from freezing was encountered on account of the very cold weather. As long as the water was kept in motion through the sluicing pipes there was not much delay from freezing, but if for any reason the flow was stopped it became necessary to thaw the pipes. The construction organization became so proficient in the use of the plant, however, that comparatively little delay was caused during the winter on account of freezing of the water-supply. Constant at-

LAPPED TROUGH SECTIONS CARRY SLUICED EARTH FILL

tention was required to keep the ice removed from the sluicing troughs in order to prevent obstruction to the flow of the sluiced material, but it was found that with a reasonable amount of attention very little ice was deposited in the embankment and there was no tendency for the sluiced fill to freeze so long as water was allowed to run over the surface.

When the temperature remained below 15° F. for more than a few hours sluicing was stopped. The embankment surfaces under construction were cleared of snow and ice when starting anew. In some cases, where it was not possible to make a continuous fill, the ground froze, and it became necessary to utilize steam jets for thawing the frozen material before sluicing was resumed in that particular location. These steam jets gave very satisfactory results and it was found possible to thaw a surface of considerable area by means of one pipe left in place for several hours.

In order to provide suitable accommodations for a working force of about 600 men, many of whom had families, considerable care was expended in the layout of the camp. Single men were housed in bunk-houses, each of a capacity of about 30 double-deck iron beds. The married men were provided with shacks 16 x 16 ft., which were constructed by the company at a cost of $60 to $70 each and rented at $3 per month. A sewer system was installed throughout the camp, discharging into the main river below the site of the dam, and drinking water from springs was pumped throughout the grounds. One combined wash room, toilet room and bath room was provided for each two bunk houses, and sanitary toilet facilities were also provided for the shacks in the camp. The unmarried foremen, engineers and office men lived in a 10-room staff house, most of the rooms being provided with double-deck steel bunks. Because the plant was some distance from a town, it was considered advisable to provide to some degree for the entertainment of the men, and accordingly a moving picture theater and a pool room were installed. A well equipped general store and a barber shop were operated by private persons. The dining hall was operated by a commissary contractor, who was required to maintain a specified standard of service.

Concrete Lined Pit Built Without Shifting Bracing

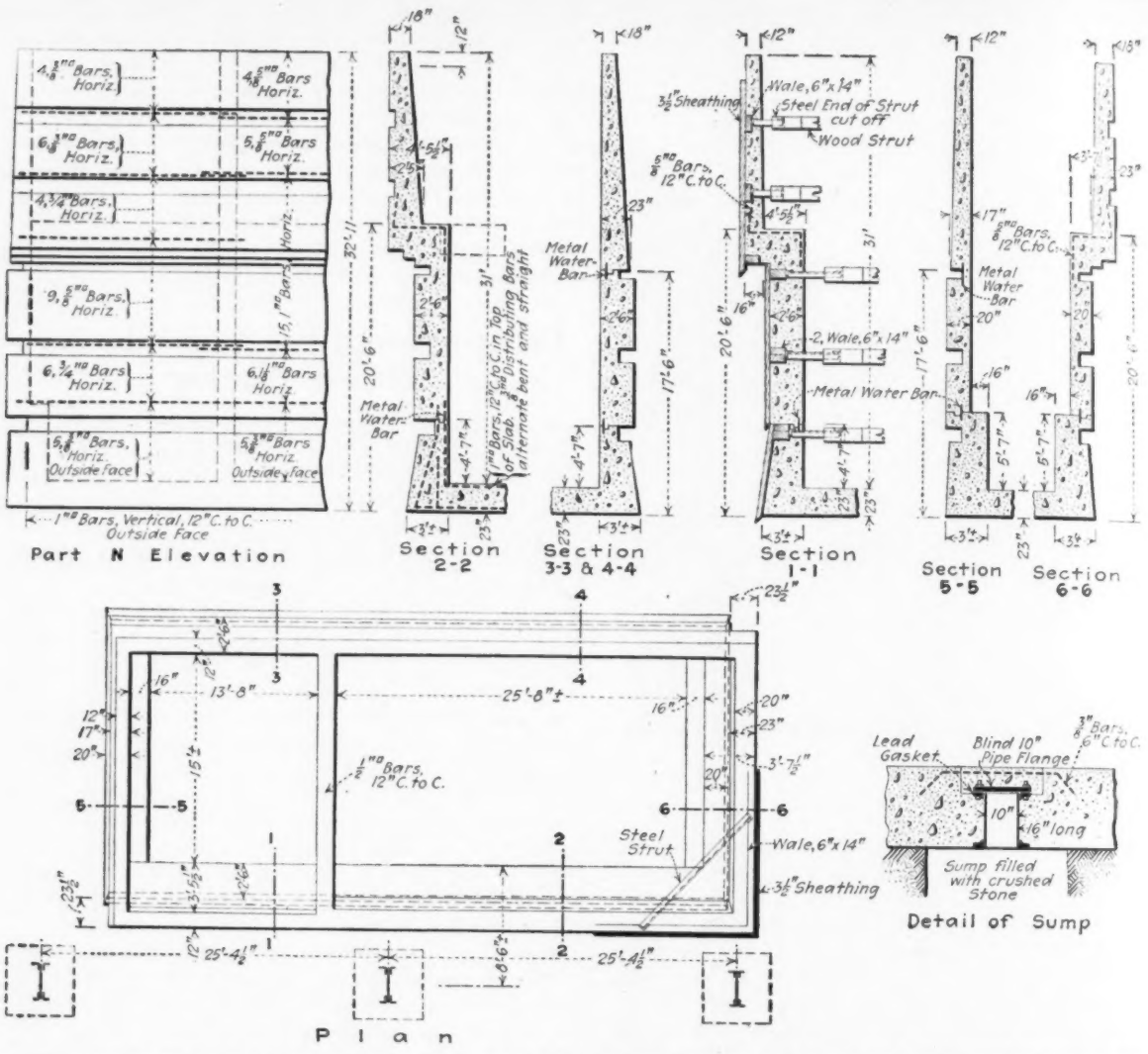
Concrete Sides Embed Sheeting, Wales and Brace Ends — Relief Sump Permits Placing Bottom Against Heavy Head of Water

By H. D. Loring
Chief Engineer Ferro-Concrete Construction Company

CONSTRUCTION speed was materially increased by sacrificing salvage of sheeting in building a concrete lined pit for the new heat treatment furnace of the Pollak Steel Co., Carthage, O. By leaving the sheeting in place as a back form for the concrete walls, and using braces with steel beam ends, the concrete was placed without shifting a single timber and without leaving any holes to be plugged. It was possible also to make the concreting a continuous operation, which helped further to insure water-tight construction. All the work was done against a heavy head of water, and in placing the concrete bottom a relief sump kept the pressure down until the concrete had hardened to sufficient strength to resist the upward thrust of nearly 1700 lb. per square foot.

Necessity of completing the pit, which was emergency construction for war work, in great haste, was the contractor's main reason for the construction methods and the lining design adopted. As the plan indicates, the north side of the pit was located as close as possible to a line of existing steel columns, each of which carries a dead load of about 30 tons to a concrete footing 5 ft. square at a depth of 5 ft. A bed of gravel from 12 to 14 ft. deep overlying stiff blue clay was to be penetrated. The gravel to within 5 ft. of the surface was saturated. This necessitated designing the walls and the pit timbering for water pressure, which, as stated, amounted at the pit bottom to 1700 lb. per square foot. This was slightly less than the weight of the concrete structure. The contractor's original instructions were to carry the pit to a depth of 27 ft.; the design was prepared on this understanding and the sheeting, bracing and excavation were completed. Then it was decided to increase the depth by 5 ft., and the plans had to be enlarged. The drawings show the design and construction as they were finally worked out.

Speed of construction was the controlling factor. The temporary bracing had necessarily to be heavy, and it was important that it should be so designed that it could be maintained during wall construction with the least possible hindrance to concreting. Usually temporary bracing is handled in one of two ways. By one method it is necessary to (1) form and concrete the wall



SHEETING USED AS BACK FORM AND STEEL ENDS OF BRACES CUT OFF AND LEFT IN WALLS OF FURNACE PIT

to the bottom of the first wale, and when the concrete has hardened slightly (2) to place another wale against the inside form at the level of the completed concrete; (3) cut off the horizontal struts and move them down against the new wale; (4) remove the second wale; (5) build forms to the bottom of the next wale, and repeat the cycle. The alternative is to build forms for the entire wall, using an outside form within the wales and boxing around the struts, which, with the wales and sheeting, are removed after the concrete has set. Both methods permit salvage of the wales and struts; the second method facilities salvage of the sheeting, but the difficulty of plugging the holes left for the struts makes it inadvisable for water-tight work.

The contractor decided to save time at the expense of salvage and use the sheeting as the outside form; then to form the inside of the wall completely; concrete the wales and struts in place, and afterward cut off the ends of the struts. This method permitted pouring the entire pit in one operation. Accordingly, the wall between the wales was designed to carry the pressure from center to center of wales, and a minimum of 6 in. of concrete was allowed over the wales. The ends of the struts which passed through the walls were made of steel sections protected with paint, and the projecting ends were burned off after the concrete was hard. No wood passed through the wall.

The walls above the original bottom were designed as continuous slabs, and the details are sufficiently indicated by the drawing. When the additional depth was ordered, it was necessary to drive a third stage of sheeting within the area already sheeted, which made it impossible to design the lowest walls like the others, on account of the limitation imposed on the thickness. Accordingly, they were designed to cantilever off the bottom, the increased thickness necessary at the junction with the floor being obtained by driving the sheeting at an angle. The bottom is a slab 23 in. thick reinforced for upward pressure. The wall between the furnace and oil tank spaces was originally designed as a partition and strut only, but after the pit was completed it was strengthened to carry liquid pressure.

The sheeting and bracing were constructed of materials immediately available. For sheeting 4 x 6-in.

yellow pine dressed and matched planks were used, and the wales were made of one or two sticks of 6 x 14-in. oak spaced 5 to 6 ft. apart. The horizontal struts were 8 x 8-in. timbers with ends of steel, as shown by the drawing.

Placing of the Struts

They were located so as to clear the ¾-cu.yd. clamshell used for excavating, and to miss the form work for the dividing wall, as well as to provide extra strength opposite the steel columns. The only provision for taking care of these columns was to sheet tightly and brace strongly, leaving the sheeting in place and pouring the wall against it. As the sheeting below the footing is under water, no trouble is anticipated from its rotting.

The 4 x 6-in. sheeting used was available in 12- and 14-ft. lengths, so that two stages were sufficient for the depth originally planned. On the south side, the location of the outer face of the wall was determined by the position of the lower stage of sheeting, so two forms were used for the upper portion and the top sheeting was removed and the wall back filled. On the north side this could not be done on account of the columns, and the upper portion of the wall was offset so as to come directly against the sheeting.

The contract was awarded Apr. 16, 1918, and the site was turned over to the contracting firm Apr. 26, the necessary plant having been assembled in the interval. Excavation was started with a stiff-leg derrick and a ¾-cu.yd. clamshell, which was used as a bucket when the stiff clay was reached. Sheeting was started by hand, and when the driving became hard a steam hammer was used.

Provision of Pumping Capacity

Plenty of pumping capacity was provided by a 7 x 7 x 10-in. duplex pump with 5-in. discharge operating at 90-lb. pressure of steam obtained from the boiler which ran the concrete mixer. Another boiler was used for the derrick. The original depth specified was reached May 15 and the final depth of 32 ft. below the surface May 21. At that time the great pressure on the bottom made it necessary to handle a large volume of water to keep the hole from flooding. A sump hole was dug in the middle of the pit and an 8-in. pipe was run through the bottom to act as a suction well for pumping until the bottom was strong enough to sustain the pressure, when the pipe was capped. The details of this well are shown on the drawing.

No particular trouble was encountered during the excavating. The steel ends for the struts and the diagonal steel struts used at the corners were not originally made heavy enough to take care of the eccentricity developed by the necessarily rough work of erecting temporary bracing, and were reinforced on the job. Liberal factors of safety are considered advisable to meet such conditions.

Concrete was started May 25 and finished May 29, and forms were removed June 3. A few troublesome leaks developed where the concrete was imperfect; they were dealt with and stopped by the usual methods of bleeding and calking.

Norfolk & Western Electric Operation Found Highly Satisfactory

FREIGHT movement by electricity during October, 1917, cost 26% less on the Norfolk & Western Ry. than if steam had been used, according to the latest annual report of that company. This statement and numerous other data assembled by the *Electric Railway Journal* are cited by that publication in a recent issue as evidence that the electrification of a mountain section of the Norfolk & Western in 1915 has proved an excellent investment.

One of the chief points argued for the electrification is that last winter, when unusually severe weather conditions hampered the steam roads so greatly, the Norfolk & Western was able to maintain a normal flow of traffic. This traffic is mainly in coal, and it is estimated that during the winter 50% more coal was shipped than could have been transported under steam operation.

An important factor in the situation is the rapid increase of traffic on the Norfolk & Western. Since electrification the tonnage handled without additional locomotives has increased 50%. Before electrification it was possible to haul eastbound a maximum of about 40,000 tons daily, with trains of 3300 tons, while on May 4, 1918, 61,200 tons of coal were so handled. On the heavy grades the steam locomotives averaged about 7 miles per hour, while in the Elkhorn tunnel the speed was as low as three or four miles. The electric locomotives maintain a constant speed of 14 miles. Steam trains formerly left Bluefield with two Mallet engines for trains of empties, and a Mallet pusher was added at the steepest grade on the return trip for 3300-ton trains. Now one electric locomotive starts out the same number of empties, and a pusher is added for 3300-ton loads up the heavy return grade.

An element of superiority noted for electric operation is the decrease in standing time. An electric engine is allowed 45 min. terminal turning time, for change of brakeshoes, journal inspection and the like; Mallet locomotives averaged 10 hours.

The average loss of engine-hours is only one-half of one per cent., despite the fact that certain new departures were made in the design of the locomotives, and that the large volume of traffic has made long shoppings impossible. The locomotives are overhauled once a year.

Bulletin Gives Physical Tests of Road Stone

Bulletin No. 670, recently issued by the United States Department of Agriculture, gives the results of the more common physical tests of approximately 3650 road-building rocks of the United States. The bulletin contains a complete record of all crushing strength tests made prior to Jan. 1, 1916. The tests show that the average crushing strength of granites and gneisses lies between 20,000 and 21,000 lb. per square inch, and that the average for limestones and dolomites lies between 18,000 and 19,000 lb. per square inch. The bulletin states that granites, gneisses, schists, sandstones and quartzites should not, in general, be used in the wearing course of water-bound macadam roads, and that shales and slates should never be so used. This is on account of the low cementing qualities of these materials.

June Floods Cause Damage to Bridges in Iowa

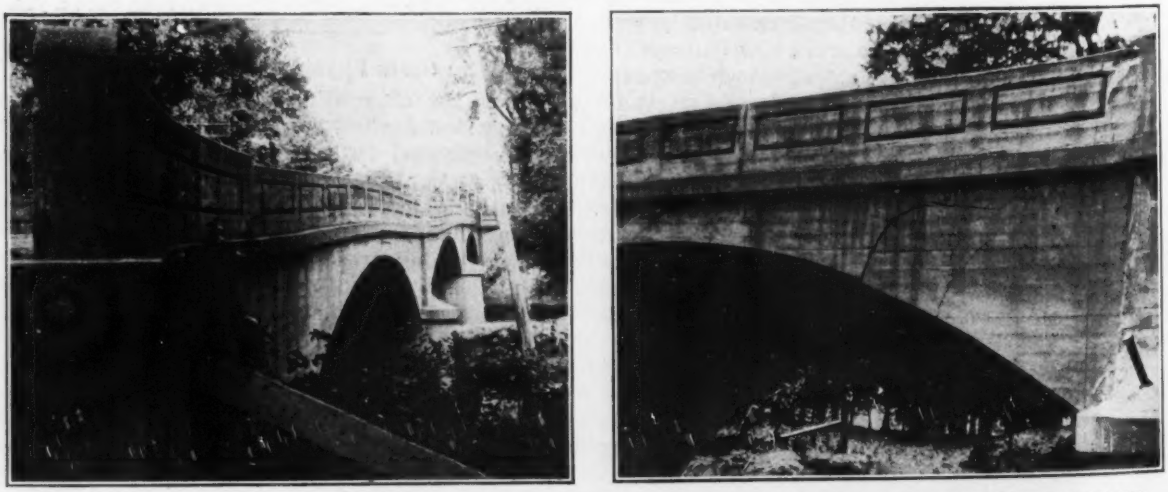
Serious Interference with Highway Traffic Results from Undermining of Piers, Fall of Spans and Washouts in Roads

TYPICAL FLOOD DAMAGE ON ROAD BETWEEN AMES AND STORY, IOWA

DAMAGE to roads and highway bridges in Iowa by the June floods is estimated to involve about $250,000 for repairs and reconstruction. This damage seems to have been most serious in Story County, where it was under the direct observation of the engineers of the State Highway Commission and the Iowa State College at Ames. Results of these observations, as given below, are taken from the July *Service Bulletin* of the State Highway Commission.

"Rain began on Sunday morning, June 2, and on Monday night there was a storm which resembled a cloudburst in its effect. High water and washouts isolated the state college until Tuesday noon, when the repair of a culvert made it possible to get from Ames to the college by a 14-mile route, the direct distance being only two miles. On Wednesday the repair to a steel bridge made a 9-mile route practicable. Similar conditions existed elsewhere. A pile trestle was built across a washout in the road between Ames and the college, but on June 28 a more serious break was caused by the failure of the concrete bridge over Squaw Creek, having three 45-ft. arch spans. While an express wagon was crossing the driver was alarmed by a crushing sound. He reported this and the bridge was partly barricaded.

"The city engineer from Ames and men from the Highway Commission made an examination and soundings. Cracks had opened in the arch rings and the spandrel walls, and one pier showed considerable settlement, but instruments kept on the bridge for several hours showed no further settlement. City engineers placed red lanterns as a warning, but traffic continued to use the bridge. Any detour possible at this time meant several miles of travel between the two points. At about 9:45 p.m., while an automobile was in the middle of the first span, the span gave way and slowly



SETTLEMENT AND CRACKING OF SQUAW CREEK BRIDGE RESULTED FROM UNDERMINING OF PIER IN FLOOD

sank, carrying the car with it. The span was not over the bed of the stream but a considerable hole had been scoured out to a depth of 5 to 7 ft. The car upset, but the three occupants were not precipitated into the water. The second span went down almost at once, but the third span remained standing for nearly a quarter of an hour.

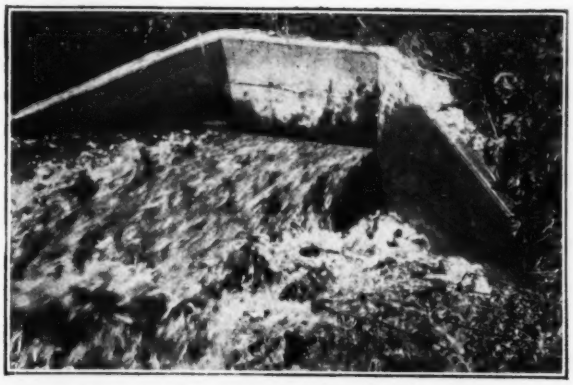
"The bridge had been built in 1908, with a concrete floor in the stream bed. This floor had broken up and disintegrated and the reinforcing had rusted badly. The bridge was built over the protest of the engineers from the engineering department of the Iowa State College and of the State Highway Commission which, at that time, had no authority to enforce standards or supervision of construction, but was in the position of giving advice only when advice was asked. The claim of the engineers was that the bridge was not of good

SQUAW CREEK BRIDGE COLLAPSED ON DAY AFTER SETTLEMENT AND CRACKING WERE OBSERVED

design, that reinforcing metal was insufficient, improperly placed and overstressed, and that the concrete was also stressed beyond the point of safety, according to best standards in bridge design. The bridge was built at a cost of $6500, a saving of some $1500 over bids on a concrete-arch design submitted by the Commission engineers. It will probably cost $15,000 to construct an adequate bridge at the old site and under conditions as they are at the present time."

The bridge wreck with the overturned automobile, is shown in one of the accompanying views. Design features of the bridge are noted in the *Bulletin* as follows: "Computations showed stresses in reinforcement metal reached 33,000 lb. Good practice limits such stresses to 16,000 lb. The elastic limit of the steel approximates 32,000 to 33,000 lb. The breaking point is 45,000 lb. The concrete had a maximum stress of 805 lb. per square inch, where it should not have had more than 500 lb. The pavement floor in the stream bed was badly broken up in 1911. The bridge was built in 1908."

Undermining of foundations by deep scour was a leading cause of bridge failures in these floods. At the two-span concrete arch bridge over Skunk River, near Ames, the torrent scoured out the bed to a depth of 15 ft. below the normal level, and although the center

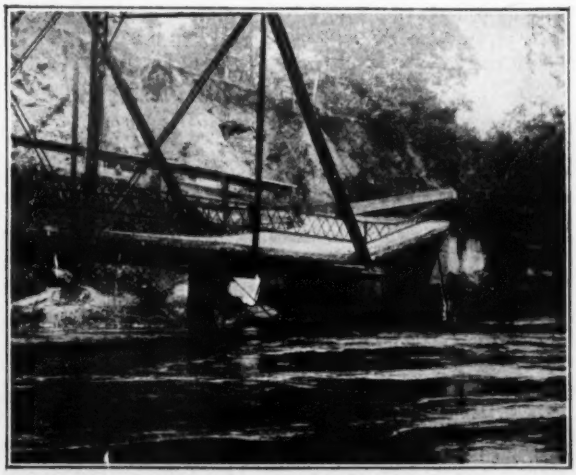


DISCHARGE OF 48-IN. BOX CULVERT IN JUNE FLOOD

pier was carried on piling it failed and caused the collapse of the spans. At the Chelsea bridge, in Tama County, with two 50-ft. pony-truss spans, the pier was undermined to a depth of 9 ft. beneath the footing, while one abutment was undermined 6 ft. The pier settled 2 ft. but piling prevented collapse of the bridge.

The damaged steel span on tubular piers shown in one of the views is on the Skunk River. One of the tubes settled about 2 ft., but piling was driven and the bridge shored up. In the condition as illustrated it formed for several days the only crossing of the river for a considerable distance. The cases mentioned are typical of many others, and there was also extensive loss in culverts and small wooden bridges. Concrete box culverts of the highway commissioner's standard design are mentioned in the report as having stood up well. A 48-in. culvert of this type, discharging 200 cu.ft. per second, is shown in one of the illustrations printed herewith.

Highways suffered severely from washouts, as shown by the accompanying view of damage to the road be-



TUBULAR PIER SETTLES TWO FEET AND NEARLY DROPS BRIDGE INTO RIVER

tween Ames and Story. For miles the roads were under water, and even when this became shallow it concealed holes and washouts so that it was dangerous for traffic to pass.

Organization of Government Railroad Administration

Chart and Explanatory Data Showing Branches and Their Functions Which Have To Do with Construction and Other Engineering Matters

SINCE the organization of the United States Railroad Commission, set forth by text and chart in *Engineering News-Record* of Apr. 11, p. 723 (the matter published being taken from a report of the railroad committee of the Chamber of Commerce of the United States), the organization has expanded beyond the point where it can be shown within the compass of this journal. A new 31-page report and diagram have been prepared by the committee as of Aug. 10. The diagram here shown, and the explanation of the functions of the various departments, are based on this report, but departments with which the engineering profession has little to do are eliminated.

Central Administration

Passings of the functions of the Director General, the Assistant Director General and the Division of Law, which it is not necessary to explain here, the purpose of the Division of Finance and Purchases is to coördinate and supervise railroad purchases of materials and supplies, and to develop plans for meeting the financial requirements of the railroads, whether their needs relate to the taking up and renewal of obligations and the issuance of new securities, or to financial provision for betterments and additions. The Finance and Purchasing Sections Advisory Committees assist the director respectively in the financial work of the division and in the coördination and supervision of railroad purchases of equipment, materials and supplies. The function of the Procurement Section is to follow up and expedite the delivery of equipment ordered by the Railroad Administration, by keeping in close touch with the progress of the work at the different plants and by rendering such assistance as is possible in the procurement and delivery of materials needed. That of the Forest Products Section is to procure forest products used in railway work, such as ties, timbers, etc. The function of the Advisory Committee on Insurance and Fire Protection is explained by its title.

Division of Operation

Several sections of the Division of Operation having no direct bearing on engineering are omitted from the diagram. The Car Service Section deals with all matters relating to car service, including (a) the relocation of freight cars; (b) provision through the regional director, on application of proper Government authorities, for preference in car supply and movement where more than ten cars are involved, and (c) the recommendation of embargo policies and exemptions as the needs of the Government, seasonal requirements or other governing circumstances may demand. The Car Record Office records the movement of carload shipments of United States Government freight.

The Mechanical Department exercises supervision over all rolling stock and over the shops where repairs to this equipment are made; prepares plans and specifications for new equipment, and equalizes the distribution of repair work to different shops and the distribution of motive power among the railroads.

The Committee on Standards follows up standard plans for the purpose (1) of recommending changes which may be found necessary in standards already adopted as to cars, locomotives and the specialties used thereon; or (2) of developing additional standards.

To standardize operating statistics and to keep the Railroad Administration currently informed as to results of railway operation as revealed by the statistics is the function of the Operating Statistics Section.

The Marine Section supervises the operation of shipping under the control of the Director General, and aims to coördinate all other shipping (including that on the Great Lakes) and the railroads.

The Washington and Cincinnati Freight Traffic Control Committees exist for the respective purposes of controlling freight at the gateways of Potomac Yard, Hagerstown, Md., and Hampton Roads, and the Ohio River gateways at Cincinnati, Louisville, Cairo, Evansville, Paducah and Portsmouth. Each may decide upon embargoes affecting traffic through its gateways.

While the Division of Traffic has many sections, they are not of direct concern to the engineer.

Capital Expenditures, Labor, Accounting

To receive and pass upon the reports made by the railroads as to their budgets of necessary expenditures for improvements, and to exercise supervision over capital expenditures, are the function of the Division of Capital Expenditures.

The Division of Labor exists to deal with problems of railway wages and conditions of employment, and to aid in bringing about a better understanding between railroad officers and employees.

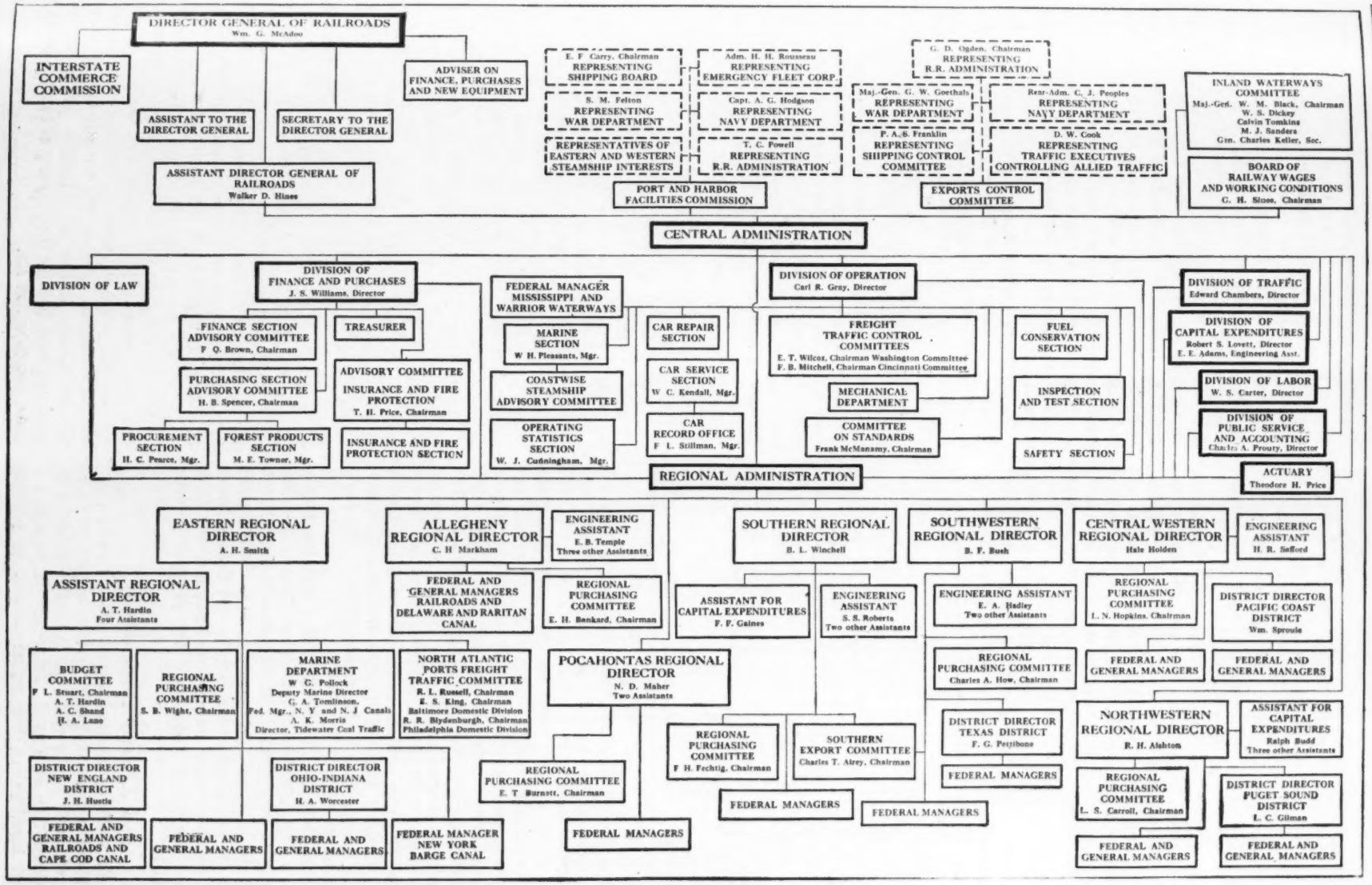
The Division of Public Service and Accounting supervises inventories of the railroad properties of which the Government has control, together with receipts and expenditures of their operations, and deals with all questions raised by any portion of the public as to the adequacy of the service rendered to shippers and consignees.

The Actuary's function is to compile and analyze statistics and make reports concerning various economic problems connected with the functions of the Railroad Administration; also to direct the work of the Bureau for Suggestions and Complaints, to which the public has been invited to address criticisms, commendations or suggestions.

Regional Administration

Seven regions now exist in place of the three defined in *Engineering News-Record* of Apr. 11. Their approximate boundaries are shown by the accompanying map (page 504).

More or less difference is found in the general staffs of the different regional directors. In the Eastern Region there is the Budget Committee (which was formed before the Eastern Region was subdivided, and so has jurisdiction over the three regions). Its function is to study the plans for additions and betterments

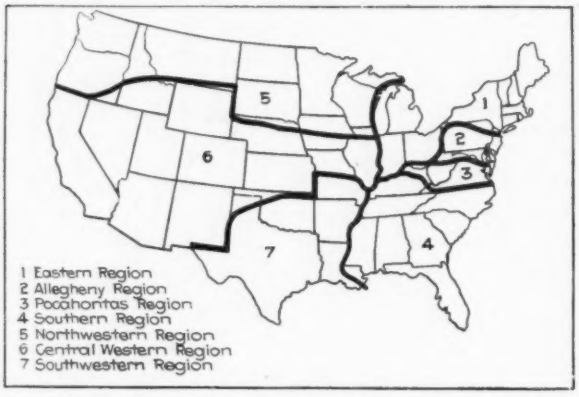


ORGANIZATION OF THOSE BRANCHES OF THE UNITED STATES RAILROAD ADMINISTRATION THAT DEAL WITH THE PROBLEMS OF THE ENGINEER

(including equipment) and for road extensions proposed by railroads in the Eastern Region, and to report from time to time on the needs for additional facilities. A. T. Hardin, a member of that committee, is assistant regional director. In most of the other regions similar duties fall upon the engineering assistant or the assistant for capital expenditures.

Each region has a Regional Purchasing Committee, whose function is to standardize and consolidate purchases of every kind that may admit of such treatment, and to submit to other regional committees and to the Director of Purchases in Washington, as information and for criticism, full statistics as to cost prices of materials used in railroad operation, so that these prices can be carefully prepared and checked.

In the Eastern Region the Marine Department has been created to coördinate the work of the Marine Section of the United States Railroad Administration



KEY MAP OF THE SEVEN REGIONAL DISTRICTS

with related activities of the United States Fuel Administration and of the port authorities of New York harbor.

The North Atlantic Ports Freight Traffic Committee controls carload domestic freight (except freight consigned to an official of the United States Government) for coastwise vessels via the ports of New York, Philadelphia and Baltimore; and makes effective when necessary embargoes issued by the several lines reaching those ports; and, when conditions warrant, issues railroad shipping permits as exceptions to embargoes. The Baltimore and Philadelphia Domestic Divisions control the movement of domestic freight into their respective ports.

Serving both the Southern Region and the Southwestern Region, the Southern Export Committee exists to issue permits covering all export business through South Atlantic and Gulf ports, and to see that freight originating in Southern territory is sent through those ports and distributed among them in such a way as to prevent congestion and obtain the greatest possible efficiency.

Advisory Commissions

Of the advisory commissions and coöperating agencies on which the Railroad Administration is represented or with which it is directly concerned, the function of the Committee on Inland Waterways is to make a prompt investigation, and report as soon as possible a definite plan describing the extent to which and the manner in which additional use may be made of internal waterways for the economical and expeditious movement of the traffic of the country, so as to relieve or supplement the railroads under existing war conditions. On the basis of reports this committee has submitted recommending steps to relieve the railroad of freight that can better be carried by water, managers have been appointed for the Cape Cod Canal, the New York and New Jersey canals (the New York Barge Canal and the Delaware & Raritan Canal) and the Mississippi and Warrior River waterways. It has also effected the operation by the Lehigh Valley Transportation Co. of the lake-line service between Chicago, Milwaukee and Buffalo in order to relieve the car situation as much as possible.

The function of the Board of Railway Wages and Working Conditions is to hear and investigate matters presented by railroad employees and their representatives affecting (1) inequalities as to wages and working conditions, whether as to individual employees or classes of employees; (2) conditions arising from competition with employees in other industries, and (3) rules and working conditions for the several classes of employees, either for the country as a whole or for different parts of the country; and to give hearings upon and investigate other matters affecting wages and conditions of employment referred to it by the Director General. This board is solely an advisory body.

Port and Harbor Facilities Commission

The function of the Port and Harbor Facilities Commission is to take charge of and be responsible for the construction of new port facilities and the extension of existing facilities which the Shipping Board or the Emergency Fleet Corporation may authorize and make appropriations for; the commission being authorized in carrying out such work to arrange and negotiate contracts and to utilize such agencies of the Shipping Board or the Emergency Fleet Corporation as may be available, and where practicable to utilize any Government agencies that will be helpful in the situation.

The Exports Control Committee is authorized (1) to inform itself as to (a) the probable amount of freight which may be exported for the prosecution of the war; (b) how this war freight can best be routed to the various ports; (c) how much of other essential traffic has to be handled, and (d) the amount of local traffic necessary for each port; (2) to select the port to which specified freight shall be transported for shipment overseas for use of the War and Navy Departments, the Allied governments and others; (3) to decide the distribution of the combined amount of all exports between the various ports so as to facilitate its handling at and avoid congestion in any common port.

All of the powers conferred upon the Interstate Commerce Commission by the act to regulate commerce and acts supplementary thereto are retained by the commission, except the power to suspend rates initiated by the President. Among the various bureaus under the commission is that of valuation, whose function continues to be to value the property of common carriers under the valuation act.

LETTERS TO THE EDITOR

Comment on Matters of Interest to Engineers and Contractors Will Be Welcome

Data Wanted on Experiences with Gauntleted Railroad Tracks

Sir—If any of your readers is able to furnish the writer, either to him direct or through the medium of your columns, with data concerning actual experience with railroad tracks gauntleted, he will be very much indebted for the same. Such data as relate to gauntleted steam railroads with electric railway tracks, especially covering advantages and disadvantages in operation, would be particularly appreciated.

F. H. FRANKLAND,
Consulting Engineer.

New York.

Commission Control and Credit Hazard

Sir—I have read with interest the editorial entitled "Does Commission Control Remove the Hazard of Investment?" in your issue of Aug. 8, p. 255. I agree entirely with your trend of thought. The point raised is so nearly like a question under discussion by our own commission during the Indianapolis Water Co. hearing I am inclined to believe it may be that hearing you have in mind.

The closing sentence of the opening paragraph of the editorial reads: "At the same hearing one of the commissioners expressed himself as not interested in the question of dividends, but as being very much interested in the maintenance of service by the company." If this reference is to the Indiana commission the words "service by the company" should have read "the credit of the company," which would of course change all that follows in the editorial.

This commission is not concerned greatly in the question of dividends, but it is tremendously concerned in the maintenance of credit of utilities, and to its credit, I believe, is the fact that, in the period through which we have been passing and are now in, that is trying every weak financial link, we have not had a public utility go into the hands of receivers. We are making a most strenuous effort to keep them in such financial condition that they will be able to meet obligations which are falling with increasing weight on them.

Whether your comment does have in mind the Indiana commission or not, I am certain you will be pleased to have this letter of comment on your editorial expression.

I believe as you do that commissions are now passing through the most crucial period of their existence. They are on trial. It is therefore unfair to the commissions, in such ordeal, to have any misinterpretation or misunderstanding of their attitude, especially when it seems to be in direct line with the thoughts expressed by yourself. You must certainly know that not all companies that appear before commissions come with legitimate claims, and I am inclined to think that some public utility representatives have been more or less unfair to commissions in reporting to papers such as your own attitudes or expressions which are not correct.

E. I. LEWIS,
Chairman Public Service Commission of Indiana.

Indianapolis.

Should Combine Breadth with Intensity of Engineering Education

Sir—Your editorial in *Engineering News-Record* of Aug. 22, entitled "Engineering Education for War-Time and Reconstruction Periods," and the articles referred to therein, were read with great interest by the writer. He agrees with you that "engineers are needed as never before," that "their qualifications must be higher," and that "to meet conditions we must have more and better engineers." The best way to obtain such is another matter, and with the tone of your editorial on this question he does not quite agree.

After the war, questions and projects of national and international importance will arise and the problems involved will be big and complex. If engineers are to have their say and play their part and are to be the leaders they assert they should be, then they must be ready to meet the test. They must be engineers of wide vision and generous training, not mere technicians. "Better engineers" must be broader and bigger thinkers than in the past. The big place will be for the big man, and not the narrow specialist

Will the suggestions as set forth, and seemingly indorsed, in your editorial secure the desired results? Will not the concentrating of engineering courses into three years have the effect of narrowing the perspective of the embryo engineer? In the program outlined by Mr. Silcock nothing but technical studies is proposed. His idea of "articled apprenticeship" is, of course, essentially British and probably would never find much favor in this country, and we need not therefore consider very seriously this aspect of the question. "Intensive training" and "concentration" in engineering education are well enough to meet a war emergency, but if persisted in will they not tend to produce the "old school" engineer? Surely we want to get away from the type which prided itself on its aloofness and self-sufficiency.

Both *Engineering News* and *Engineering Record* have been staunch advocates of the "broad" engineer, and in looking through their columns one is forcibly struck by the fact that recent thought in the matter of engineering education has been along the line of lengthening, rather than shortening, the courses. More time was to be devoted to cultural subjects and to the study of modern business science. The idea of increasing the hours of work and cutting vacations is good, but in order to secure the best results the scheme should be worked out in such a way as to make a substantial net gain in hours. If this were done, then these cultural and economic subjects could be added. Perhaps the ideal method is the "coöperative system" which has been so successfully used by the University of Cincinnati. Rutgers does well to pattern after it. But why should *Engineering News-Record* approve decreasing the benefits by shortening the course?

Another factor in the making of "better engineers" is membership in engineering societies, both national

and local. The value of this to young engineers has never been sufficiently emphasized. Local societies are particularly valuable in this respect. The writer's experience with the Brooklyn Engineers' Club was very interesting. There, opportunities to meet and become acquainted with engineers of mature judgment, as well as with younger engineers, in various lines of work, were afforded. Instructive talks and lectures were given every week; a good engineering library was available, and periodic Saturday afternoon inspection trips were made. This is merely typical of the opportunities offered by local societies all over the country, and young engineers and students should be urged to take advantage of them.

Does it not seem, therefore, that the tendency to intensify training should be viewed simply as a war measure, and that any other view is fraught with danger? If engineers are to become "leaders of men" they must be not only intensively, but broadly, trained.

EDGAR A. VAN DEUSEN,
Southern Power Company.

Charlotte, N. C.

[We gladly give space to this plea for continued breadth of engineering training, although we did not intend to suggest anything to the contrary—especially not after a return to normal times.—EDITOR.]

Continuity Undesirable in Some Bridges

Sir—Referring to the editorial remarks on "Continuous Bridges" in *Engineering News-Record* of Aug. 22, p. 346, there is a very practical phase of this question which you fail to mention. Where spans are connected across piers, any damage to one usually affects the adjacent span, possibly with disastrous results. Thus, a freshet, a derailed train, an undermined pier or any one of a hundred and one things in practical railroad life may work havoc to a continuous *bridge;* whereas, if the spans were separated, not the *bridge* but a *span* only would be in trouble. This is handled with comparative ease.

It is an open question whether adjacent spans should be upon a common pedestal; and it is very safe practice to make separate pedestals with a thick unbroken bedplate under both.

The question over and above simplicity and accuracy of design is one of keeping the line open, where the delay of even a fraction of a day costs untold annoyance and expense—enough to blot out the figured saving upon hundreds of continuous spans.

MASON R. STRONG.
New York City.

Were the Former Days Better Than These?

Sir—The article "Looking Back Half a Century," in your issue of Aug. 8, though interesting, has a tendency to put the engineering profession of that day and earlier in a wrong light to the younger practitioners of today. I gather this from remarks made to me by some of the younger members of the profession.

There are several points in the article to which the writer begs to take exception. He has been a practitioner for fifty years and knew personally some of the prominent engineers of those early days and was assistant to others—such men as the elder Trautwine, Benjamin Latrobe, C. Shaler Smith, William R. Hutton, Charles P. Manning, John Murdoch, Col. William P. Craighill and others.

I do not know what the practice on municipal work may have been in Philadelphia, but I do know that there was not any such bad practice in sewer construction in Baltimore and other cities as was indicated by that article. Again, on railroad and other works at that time the resident engineer had a better chance to become familiar with the practical part of engineering than he has today, as he was generally engaged from the location to the completion of the road. He had often to prepare the plans for the small bridges, culverts and other works on his residency. The chief engineer, before the advent of bridge companies, planned all the bridges and railroad buildings, and on completion of the road often was made general superintendent.

I believe the ethics of the engineers of a half century ago were far better than those of the majority of the younger members of the profession today.

NORVAL W. WALL.
Pueblo, Colo.

Engineers' and Bartenders' Salaries

Sir—I have read with interest the articles that have appeared in *Engineering News-Record* of late on the salaries paid to engineers, draftsmen and transit men, and have noted also the salaries offered in the advertisements in your "Positions Vacant" columns.

In western Wyoming the following prices for services in the various occupations here mentioned have prevailed since last winter and are in vogue at present: Bartenders, $130 per month; teamsters, $4 per day; common laborers, $4 per day (and they are scarce at that); men working in the hay field, $4 per day and board; sheep herders, paid $100 per month and board, and sleep in the sheep wagons; coal miners, anywhere from $175 to $275 per month, with an average of about $225. I have just finished quite an extensive survey and paid the "green" men $4 per day and was lucky to get them at that.

Compare these prices with those offered for engineering services, including positions in technical schools and colleges, as advertised in your "Positions Vacant" columns.

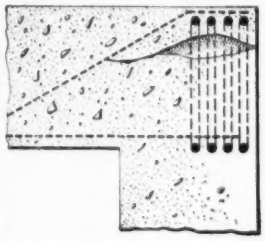
W. NEWBROUGH.
Kemmerer, Wyo.

How Much Does Concrete Shrink in a Building Column?

Sir—The writer has been in charge of a five-story reinforced-concrete building of the beam-and-girder type of construction. The floor slabs, beams, girders and exterior columns are a 1:2:4 mixture, and a 1:1½:3 mixture is used for the interior columns. The contractor must necessarily pour the interior columns separately on account of the richer mixture, but there has been considerable discussion as to the amount of time, if any, which should elapse between the time of pouring the exterior columns and the floor slab. It costs a contractor considerably more to pour the concrete in two operations, and the writer has insisted that at least two hours elapse between time of pouring

columns and floor slab, in order to allow for settlement. It is probable that the shrinkage takes place some time after the concrete attains its final set, and also that most of the settlement occurs within the first two hours.

With an idea of determining how soon this settlement took place, readings were taken on three columns, which were poured up to the under side of the girders. The first reading was taken about 45 min. after pouring and other readings at intervals of several hours, for a period of 10 hours. No difference in the elevations of the tops of the columns was noticed, which seems to indicate that the maximum settlement takes place before the concrete takes its initial set. A number of prominent engineers are of the opinion that at least six to eight hours should elapse before placing concrete on the top of columns. The final report of the Joint Committee on Concrete and Reinforced Concrete states, "it is desirable to cast an entire structure at one operation," etc., and further, "before placing the concrete on top of a freshly poured column, a period of at least two hours should be allowed for the settlement and shrinkage."



DOES SHRINKAGE CAUSE A VOID?

The writer believes his objection to pouring columns and slab monolithically is a practical one. The steel bent up over the column for negative movement from the spandrel beams together with the electric conduits coming from the column forms a network of steel in a plane about 2 in. below the top of the slab. When the column and the slab are poured together, the concrete over the top of the column is exposed to the air and the water evaporates much more readily than in the center of the column, about 10 or 12 in. below the top of the slab. This leaves the concrete on the surface stiff, while the mixture below is relatively plastic. Due to this stiffening near the surface, the supporting action of the bent-up steel, and the adhesion of concrete over the column at the top to the concrete in the beams and slab, there is a tendency for the concrete to arch over the columns. If settlement takes place, it is possible that a void is left in the center of the column 6 or 8 in. below the top of the slab, about as shown in the sketch.

On account of the large number of reinforced-concrete structures going up at this time, this point may interest other engineers, and the writer would like to see some discussion either substantiating or disapproving his contention.

CARL H. COTTER,
Assistant Civil Engineer, United States Navy.
Washington, D. C.

Engineering Degrees Open to All Who Can Pass Examinations

Sir—It seems to the writer that in these times, when there is such a demand for engineers and technically trained men in general, the time is ripe for a broader view in regard to the methods employed by individuals in obtaining technical education.

A good deal has been said of late about the subject of engineering education at colleges, and also in regard to the prestige of the profession in the eyes of the general public, but little, if any, mention has been made of the correspondence school graduate. The fact that a great number of correspondence school graduates or otherwise self-educated men are in the technical professions today cannot very well be overlooked. A good many such hold important executive positions demanding the very best of engineering ability.

Anyone of fair mind will admit that an individual who completes a good correspondence school civil engineering course, will, with the exception of higher mathematics, have a thorough training in civil engineering knowledge. Especially is this true if such a course is accompanied by actual practice. Higher mathematics, etc., can be obtained through university extension courses, either by personal attendance or by correspondence.

The writer is not prejudiced in favor of one method or another, but thinks the best way of becoming an engineer is to attend some college. The next best is to take a correspondence course and see it through. Sometimes the next best can be made the best, depending on the individual.

In cases where a self-educated engineer has, on account of his ability, risen to a high position, a peculiar condition sometimes exists. He has no degree of B.S. or C.E., whereas some of his subordinates may have the C.E. and very often the B.S.

To standardize the technical professions there should be some way of obtaining a degree by passing through an examination held either by a college, the state or the American Society of Civil Engineers, or all three, without the necessity of spending several years at some college. In other words, if an individual thinks he has acquired knowledge up to the standards required, he should have an opportunity to take an examination in civil engineering. If he passes, the degree of C.E. should be conferred upon him. If he does not, but successfully fulfills some lower requirement, he should receive a subdegree, as draughtsman, surveyor, etc. That would be somewhat along the line of civil service. Anyway, let knowledge count, and let the individual choose his own method of obtaining it.

It is the belief of the writer that if such a system were generally inaugurated it would raise the standards of the technical professions and give them a higher prestige among the general public, besides tending towards greater efficiency all around.

Richmond, Cal. GEORGE W. FORSBERG.

[Examinations for membership in the associate grade of the Institution of Civil Engineers have been held for years past. Chemical and other technical societies in Great Britain conduct examinations and give certificates of proficiency. The Royal Sanitary Institute conducts examinations for municipal sanitary inspectors. These various certificates are recognized by municipalities seeking candidates for positions.—EDITOR.]

HINTS FOR THE CONTRACTOR

DETAILS WHICH SAVE TIME AND LABOR ON CONSTRUCTION WORK

"Packing" Things Even a Few Steps Doesn't Pay

SHOVELERS on an excavation job visited recently were loading a belt conveyor which carried the dirt hardly 15 ft. to a dump car. On another job a roller chute, perhaps 12 ft. long, handles bags of cement from the receiving point to the mixer-charging bins.

Using short conveyors and chutes is an economy often overlooked in construction. Workmen carrying a load, even a 12-lb. shovelful of earth, walk very slowly, not more than 150 ft. a minute. About 150 shovelfuls are required to fill a 1-yd. car. If the carry to the car is 15 ft., the shoveler walks 30 ft. to place each shovelful and travels about 4500 ft. to load a cubic yard. Working steadily, he won't load the car in less than half an hour. Casting from where he stands to dig, the same shoveler will average 10 shovelfuls a minute and a cubic yard in 15 min. By means, then, of a 15-ft. belt conveyor the output of loaded cars can be doubled. Perhaps the gain accomplished on the work observed was not so great; possibly earth movers will choose to increase or decrease the specific figures employed in the preceding analysis, but the ratio between the speed of shoveling directly into place, and the speed of shoveling with a short carry to place, will hold about the same. Mechanical conveying, even for short hauls, effects enough economy, as compared with carriage by hand, to pay interest and profit on a considerable investment in conveying plant. C. S. H.

Other Articles in This Issue of Interest to Contractors:

Army Intermediate Depot in France Problem in Getting Labor and Supplies — Page 478
Drop Shafts Sunk Through Buried Tree-Trunks by Dredging — Page 485
Sixty-One-Foot Hydraulic-Fill Dam Rests on Earth Foundation — Page 491
Construction Methods Used on the Junction Dam — Page 495
Concrete-Lined Pit Built Without Shifting Bracing — Page 497

Sand and Gravel Washing Plant Built for Six-Mile Concrete Road

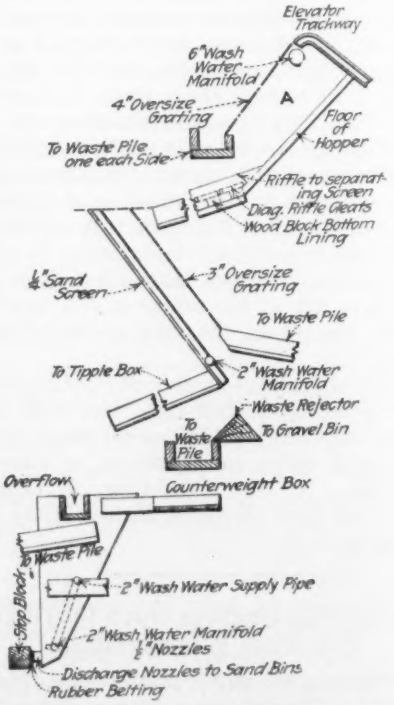
By W. L. Hill, Jr.

Seattle, Washington

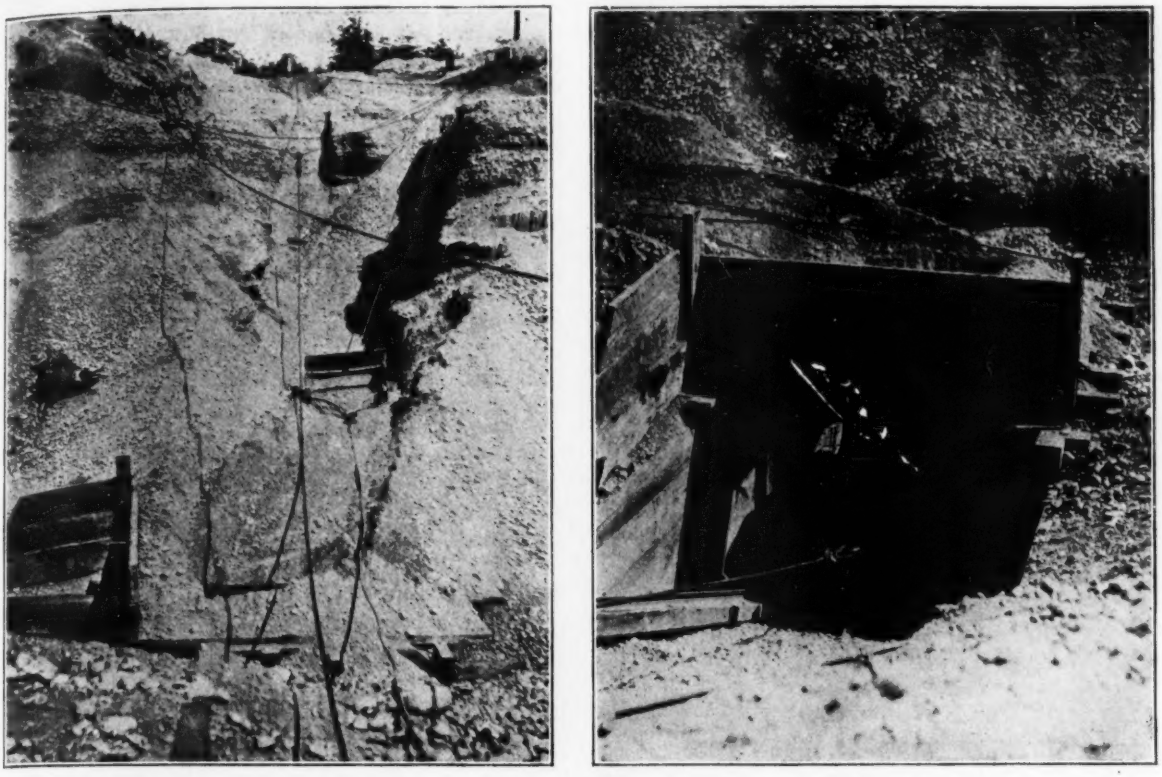
A MEDIUM-SIZED sand and gravel washing plant having a capacity of 400 cu.yd. per day was built for a 6.2-mile concrete road 20 ft. wide in King County, Washington. The plant operates with a force of five men, and when being used at capacity turns out clean sand and gravel at a cost of 7.13c. per cubic yard at present rates of wages. The smallness of the force required for operation is especially advantageous just now.

The contract for the road, the Auburn-Enumblaw highway, was let by county officials to the H. J. Kaiser Paving Co., which opened up a gravel pit near the center of the road and built the washer for the purpose of obtaining a clean aggregate. Photographs of the plant layout and a diagram of the process through which the material passes are shown herewith.

Successful operation of a washing plant is necessarily dependent upon a proper supply of water, and provision of this proved to be one of the great difficulties encountered on the work. A large spring, reputed to have great capacity, was first tried and soon pumped dry; next, several wells were tried and also pumped dry; finally, it was necessary to extend a pipe line 7300 ft. to a creek, where a sufficient supply of water was available. The creek, known as French Creek, has a flow of about 2 sec.-ft. One 3-in. triplex belt-driven pump and one 4-in. duplex belt-driven pump were mounted over a small basin into which about one-half the flow of the stream was diverted. The pumps were belted to a single-cylinder 6-hp. gasoline engine of the hopper-cooled type. Water was delivered to the bunkers through 4800 ft. of 4-in. and 2500 ft. of 6-in.



ARRANGEMENT OF GRAVEL SCREENS AND WASHERS



MATERIAL EXCAVATED AND DUMPED THROUGH PLATFORM INTO ELEVATOR CAR AUTOMATICALLY

wire-wrapped wood-stave pipe, against a static head of approximately 120 ft., as read from the pressure gage at the pumps when at rest. At the bunkers a 15-hp. gasoline engine, belted to a 4-in. centrifugal pump, boosts the water under pressure to the washing nozzle on top of the bunkers, which are 40 ft. above the supply line discharge from the creek.

Although the greatest difficulty and expense encountered in erecting this plant lay in providing the water-supply, by far the most interesting feature is the arrangement of the plant and the bunkers and the equipment for washing and grading the aggregate.

Pit-run material is excavated by a dragline scraper operated by means of a steam donkey engine. This dumps through a hole in the platform, as shown in the illustrations, into a delivery car operated by another donkey engine. The delivery car is drawn up the incline to the bunkers and automatically dumped into the first screening and washing bin.

The washing apparatus is arranged in a series of three drops, as shown in the diagram; the first being the receiving hopper at A, where the pit-run material, after passing through a grizzly of heavy bars spaced 4 in. in the clear, which rejects most of the oversize material and sidetracks it to the dump, is met by a number of streams of water issuing from ½-in. and 1-in. holes in a 6-in. manifold. The water and the aggregate then pass down a riffle about 15 ft. long, lined on the bottom with end-grain wood blocks which have diagonal 1-in. cleats nailed to them to form the riffle. The grizzly and the riffle are shown in one view.

From the riffle the aggregate passes upon the separating screens, which are most ingeniously arranged. A second grizzly with bars spaced 3 in. in the clear rejects the remaining oversize material and deflects it down a chute to the waste pile, while the sand and the gravel under 3 in. is projected with considerable force upon a stationary ¼-in. sand screen standing at an angle of about 55°. Near the bottom of this screen a 2-in. water pipe crosses it, resting directly upon it; this has a number of small holes through which water is forced in a practically continuous sheet, washing the sand and gravel as it passes.

This pipe also serves another purpose. Gravel-size material, rolling down the upper face of the screen, encounters the pipe and its spray of water and is thrown upward, and the momentum of the heavier material carries it to a chute, by which it is conveyed to the gravel bins, while the waste water, sludge and other light material fall short of the gravel chute and drop into a second chute which carries them to the waste pile. This completes the segregation of the coarse aggregate.

The material which passes through the sand screen is carried to the tipple box, which is arranged to wash the sand thoroughly before discharging it. In this box, for the discharge of the sand, there are two outlets which are automatically closed when the box is in the filling position, and above each of them is a ½-in. pipe forming a nozzle through which the washing water is forced. These nozzles point slightly upward and the streams from them keep the sand constantly "boiling," thus thoroughly washing out all the dirt and float, which are carried away through the overflow. When

INITIAL SCREENING BIN REMOVES LARGE STONE AND WASHES REMAINDER DOWN THE RIFFLE

the tipple is filled it tips automatically and discharges the sand into the bins, giving it a final washing as it flows to the discharge pipes.

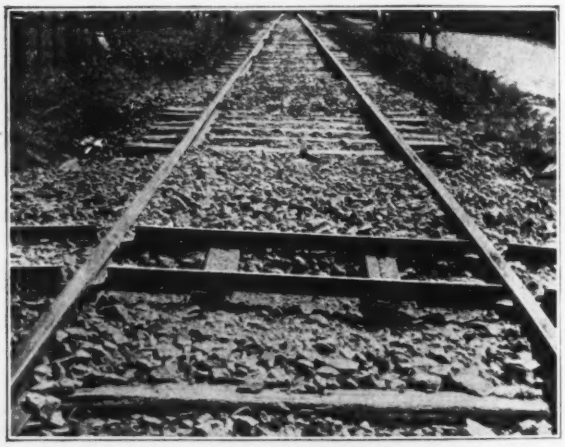
MATERIAL PASSES THROUGH SCREENS AND WASHERS TO BUNKER AND GRAVEL BINS

As finally bunkered, the material is well washed and quite evenly graded, but a fourth and final washing of the aggregate occurs as it passes down the loading chutes to the material trucks. The various operations are performed automatically, obviating the necessity of more than one attendant at the bunker; and the whole layout, besides being a notable example of special effort on the part of the contractor to obtain first-class material under adverse conditions, is well worth the attention of anyone interested in the construction of concrete pavements.

The entire crew necessary for an output of 400 cu.yd. of material per day of eight hours is five men, organized as follows: One hoistman, operating both the dragline scraper and elevator cars; the fireman; one general utility man in the gravel pit; one man taking care of the pumps and discharge chutes, and one bunkerman who also acts as foreman. Unit labor cost is thus reduced to the minimum, being at present labor prices about 7.13c. per cubic yard when the plant is operating to capacity.

Bolt Light Railway Track Sections to Crossing Railway to Prevent Derailments

A LIGHT industrial railway crossing temporarily a standard-gage electric road has been kept free from crossing derailments by bolting rigidly the two sets of rails, as indicated by the accompanying picture. The light railway carries four-car trains of gravel for road work. Such crossings are frequently built so that



CARS DO NOT JUMP THE TRACK ON THIS CROSSING

the flanges of the light car wheels ride up onto the main-line rails and fail to cross the gaps in the light-track rails. In this case, on both sides of the gaps were bolted plates bent at right angles, one arm to the bottom of the light rail and the other arm to the web of the heavy rail, so that the tops of the light rails would be held 1¼ in. above the top of the heavy rail. The light 20-lb. rails were cut to make a 5-in. gap at each crossing point. By this arrangement the flanges of the 12-in. wheels on the light cars just touch the tops of the heavy rails in passing the gaps, and the chances of derailment are greatly reduced. The crossing was designed by the Lakewood Engineering Co., for the contractor, Thomas E. Currie, Detroit, Mich.

NEWS OF THE WEEK

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Reconstruction Problems To Be Studied

National Research Council Committee, with F. H. Newell as Vice-Chairman Outlines Tentative Program

The National Research Council, in its survey of the larger possibilities of science, is making through its committee on reconstruction a study of after-war or reconstruction problems, this activity being in accordance with the executive order issued by the President of the United States on May 11.

In the matter of preliminary research as the first step in such survey, the committee is preparing a concise statement of agencies, public or private, engaged in whole or part on those matters which lead to reconstruction, with a brief résumé of the scope of action, methods and results of each.

There is general appreciation of the immediate need of such mapping of the field of action, as already there appears to be more or less confusion and overlapping of work, with corresponding neglect of important details. Many organizations and individuals are already concerned with the different phases of this broad subject and a large literature is rapidly growing up.

In order to outline the work in hand the following definition has been tentatively adopted:

"Reconstruction is the rebuilding on normal peace lines of the activities, mental and physical, which prevailed before the war, with such improvement or advance in ideals, methods and machinery as may have been made possible by recent experience. It begins primarily with the returning soldier, in his rehabilitation if necessary, and his return to the industry which best suits his capacities and desires. It includes the placing of other war workers as conditions change and of any human effort where it may be most effective. It means better use of our natural resources in lands, minerals, waters and forests, to furnish larger and more nearly equal opportunities for each citizen and the placing of industry, including agriculture, mining and transportation, on a basis to meet the changed needs of the country. In short, it means the intelligent planning and execution of plans for a better community."

The scope of research is defined as research for reconstruction which should touch upon all lines of science and especially their application to the public welfare. It should approach the subject by preparing: (a) A list of agencies, public or private, engaged in whole or in part on those matters which lead to reconstruction; (b) a résumé of the scope of action, methods and results of each agency; (c) a description of the degree of coöperation existing on related lines and which may be desirable and practicable; (d) comparison with similar efforts in other countries; (e) listing of those items of scientific research and their application not now covered by any agency, and which should contribute to the public welfare; (f) formulation of projects of research in these lines not now satisfactorily covered; (g) preparation of definite recommendations as to the methods and organization to undertake such projects.

The fields of research as they pertain to reconstruction problems may be considered as being in three interrelated classes: (a) materials, including lands, minerals, waters, forests and manufactured products; (b) men or man power, such as the returning soldier; workers displaced in war industries; young men entering business; women workers; emigrants and others; (c) ideals or principles, including the plans or theory of action which underlie laws and regulations governing the use of materials and employment of men for the public welfare.

A research into agencies for the accomplishment of this work and a listing of these concerned with reconstruction leads to a consideration of (a) Federal bureaus; (b) state departments; (c) civic organizations; (d) volunteer associations, coöperative, scientific and others. All of these are concerned to a greater or less degree with materials and men, and the plans or the principles of their utilization and employment.

[Suggestions for fields and agencies of research may be sent to Prof. F. H. Newell, vice chairman reconstruction committee, Urbana, Ill.—EDITOR.]

Engineer Corps Commissions for Men Between 32 and 42

Engineering News-Record is informed by a special representative in Washington that the Chief of Engineers is now permitted to commission properly qualified men between the ages of 32 and 42, as engineer officers. This ruling supersedes the order announced in Engineering News-Record of Aug. 15, p. 335, that no commissions in the Engineer Corps would be given until the draft law had been passed.

McAdoo Issues Final Form of Railroad Contract

Railway Executives' Committee Accepts It, but Security Holders Object on Three Counts

Director General McAdoo has announced the form of contract which the Government is willing to make with the railroads to cover the period of Federal operation, and has issued a supplementary statement explaining his position on certain debated points. He holds that no company need sign the contract, but that he will make no further changes in the general form. The Railway Executives' Advisory Committee approves the contract. The National Association of Owners of Railroad Securities still make emphatic objection to three features—that barring the security holders from the right to make claims in court for loss of traffic, that compelling them to finance and pay at present-day high prices for improvements that may be of no benefit to them, and that making the Interstate Commerce Commission the court of last resort on many important questions.

The contract comprises nine sections. Section 1 is devoted to definitions and generalities. Section 2 defines the property taken over by the Government. Section 3 stipulates that the company accepts all the terms of the Federal control act, including those relating to compensation for any loss of traffic due to Government operation, and that nothing in the contract is to be construed as prejudicing the Government's future policy concerning ownership, control or regulation.

OPERATION AND ACCOUNTING

Section 4, the longest section of the contract, covers operation and accounting during Federal control. It provides among other things that the Government shall receive all operating revenues and pay all operating expenses; that expenditures for additions and betterments shall be charged to the company; that expenses of maintaining the corporation shall be borne by the company, the Government, however, to bear such expenses of valuation as the Director General deems necessary; that the Director General shall at his option be substituted in place of the company in respect of the benefits and obligations of operating and supply contracts; that the company shall have access to the books and accounts.

Upkeep is covered in Section 5. The Government is to pay for maintenance, except that the company is to pay for such additional expenditure for maintenance as the Director General elects

to make to bring the property to safe operating condition. A clause stipulates that in case of dispute the ruling of the Interstate Commerce Commission shall be final.

Section 6 provides that the Government shall pay all taxes except war taxes assessed against the company during the control period.

COMPENSATION

Section 7 covers compensation. It stipulates the annual amount, to be determined separately for each company, guaranteed the company; and provides for quarterly payments, with deductions of amounts required to reimburse the Government for the cost of additions and betterments not justly chargeable to the Government. It is stipulated that power to make these deductions shall not be so exercised as to prevent the company from paying corporate expenses, keeping up sinking funds, or meeting interest, rents or taxes due; and that deductions shall not be made for additions and betterments for war purposes only.

This section also provides that the company shall not issue securities or enter into contracts without the Director General's approval; and that during the control period the Government shall pay the company interest at a reasonable rate on the cost of additions and betterments made during the period.

Claims for losses on additions or extensions, Section 8 provides, may be determined by agreement between the Director General and the company, or ascertained in the manner provided in the Federal control act; provided, however, that no claim shall be made because of the high cost of present-day construction.

Section 9 has to do with the final accounting. It provides for the return of the property at the end of Federal control.

OWNERS' OBJECTIONS

The National Association of Owners of Railroad Securities objects, first, to being compelled to sign away in advance, without knowledge of the extent to which the companies' operations are to be abandoned or their business diverted, their right to claim loss of traffic or good will, in return for "a compensation that was intended only for the use of their own property and not for the possible destruction of its value in the process of unification." The association asks that the question be left open. Second, it holds that the owners should not be required to finance and pay for at present-day prices improvements that they may not need. It contends that as the Government gets the whole benefit during the control period for the improvements it should bear the cost, charging for them at their value at the end of the control period. On this basis the companies would be willing to finance them. Third, the owners insist that they should have the right to appeal to the courts all decisions of the Interstate Commerce Commission.

In his supplementary statement Director General McAdoo says that provision is made for appeal to the courts for claims of losses on additions and extensions, but asserts that in other matters the commission's decision is properly final. Regarding claims for diversion of traffic, he asserts that the Federal control act definitely contemplated unified control and use, and a single basis of settlement for such unified control and use, and that the companies, if they, as is optional with them, sign the contract, should be denied the right to make separate claims for such loss of traffic. His statement does not touch the objection of the owners to paying present-day prices for improvements that do not benefit them.

Greet New Secretary of American Association of Engineers

About fifty Chicago engineers attended a dinner given at the City Club on Sept. 6, to C. E. Drayer, the new secretary of the American Association of Engineers. The president, W. H. Finley, made the introductory speech, and Isham Randolph acted as toastmaster. Among other speakers were J. N. Hatch, who presented the after-the-war problems of the engineer; L. K. Sherman, who urged the importance of local chapters of engineers; Joseph Harrington, fuel administrative engineer for Illinois, and H. W. Nichols, secretary of the Chicago section of the American Society of Mechanical Engineers.

Mr. Drayer in his address outlined the field and opportunities of the association and the advantages accruing from the desired universal coöperation of engineers and engineering societies. He urged that engineering organizations should be based on service; that engineers should put aside old jealousies, and get together and assign society work in accordance with their past development and present capacity.

Tomlinson Heads Inland Waterways

George A. Tomlinson, who for several months past has been Federal manager of the New York and New Jersey canals, has been made director of the newly created Division of Inland Waterways, under the jurisdiction of the Railroad Administration. Mr. Tomlinson is a lake shipping man of many years' experience, and was a member of the waterways committee of the Council of National Defense. The new division supersedes the Committee on Inland Waterways, of which Maj. Gen. W. M. Black was the chairman and Brig. Gen. C. Keller was the secretary, and takes over its records.

Mr. Tomlinson has been succeeded as Federal manager of the New York and New Jersey canals by H. S. Noble, president of the Great Lakes Transit Corporation, the consolidated package freight line of the Great Lakes. Mr. Noble has also been connected for many years with lake shipping.

Army Construction Costs More Than a Billion

Building construction inside the United States strictly for the war and in charge of the Cantonment Division, now the Construction Division of the Army, will total $1,083,766,000, according to a statement just issued by the War Department. To provide for the needs of the Army, the Construction Division has undertaken since April, 1917, a total of 323 operations and now has in prospect 153 more. To the end of August, 93 operations had been completed, including the camps and cantonments. The cost of the finished operations was $277,745,847. Additions and alterations of minor character are not figured as "jobs."

There are now under construction 266 jobs, which will represent a cost approximating $636,858,351. Practically all of the work now under construction will be finished by Jan. 1, next. However, some of the larger jobs, which are of a permanent nature, will not be completed until October, 1919. Included in the present construction is the development of eight port terminals at a cost of approximately $150,000,000. One of these, the Brooklyn Army Supply Base, estimated to cost $40,000,000, will have the largest warehouses in the world. The other terminals in the course of construction are at South Boston, Mass., estimated to cost $28,000,000; at New Orleans, La., $10,000,000; at Charleston, S. C., $25,000,000; at Norfolk, Va., $20,000,000; at Philadelphia, Penn., $15,000,000; at Newark, N. J., $10,000,000, and at Newport News, Va., about $5,000,000.

Projects now under way include a large number of ammunition depots, quartermaster's warehouses and storage depots in inland cities, hospitals, ordnance plants, new training camps, and the enlarging of other camps to provide accommodations for the increasing Army and the newer methods of training. The major portion of this class of work will be finished by Jan. 1, 1919.

Water-Power Bill Passes House

After a lengthy controversy over the maximum length of the license and the question of whether "fair value" or "net investment" should be the basis of recapture, the House of Representatives, Sept. 5, passed the so-called Sims water-power bill, the bill to grant licenses to private companies for the development of navigable rivers or streams in the public lands. The Senate has already passed the Shields bill for similar purposes, and the two bills will now go to conference.

The recapture provisions provoked the greatest discussion. The bill as reported provided that in paying for a water-power property recaptured by the Government after the expiration of the license the basis of payment should be the "net investment . . . as defined and interpreted in the 'classifica-

tion of investment in road and equipment of steam roads,' issue of 1914, Interstate Commerce Commission. President Wilson objected to this clause and suggested the substitution of the term "fair value not to exceed the actual cost." An amendment incorporating the "fair value" idea was submitted in two different forms but was lost, in the first vote by 71 to 83 and in the second by 128 to 133. Other amendments were similarly lost, and the committee's bill was then passed 231 to 23.

War Subjects to Dominate Safety Congress

Director General Schwab and Secretary Lane Included in List of Speakers at St. Louis Meeting

The program of the seventh annual safety congress of the National Safety Council, to be held at the Hotel Statler, St. Louis, Sept. 16-20, will be devoted in large part to war subjects, including the opening address by Charles M. Schwab, director general of the Emergency Fleet Corporation on "The Democratization of Industry," followed by an address by Secretary of the Interior Lane on "Safety as an Asset in Winning the War." "Safety in Warfare" and "Accident Prevention in the Shipbuilding Program" are other subjects included in the five-day program. The women's session, which will be held on the third day of the convention, will include an address and discussion on "The Effect of War upon Women in Industry."

The meeting of the construction section of the congress will be held Sept. 18, both in the morning and afternoon, and will include the following subjects: "Organizing for Safety—How to Secure the Coöperation of Superintendents, Foremen, and Men;" "Safe Construction of Scaffolds and Falsework;" "Effect of Accident Prevention on Insurance Rates;" "Benefits of Accident Prevention in Contracting."

The annual meeting of members will open the congress on the morning of Sept. 16, and will be followed by a general session in the afternoon, including the address by Mr. Schwab, as well as papers on "The Personnel Problem in Industry" and "The Economic Value of Health of Industrial Employees."

A public mass meeting will be held in the evening of the same day and will include the address by Secretary Lane and the New York Central R.R. Co.'s new drama safety film, "The Rule of Reason."

The second and third days of the convention will largely be given up to "sectional meetings," including the chemical, logging, miscellaneous manufacturing, public utilities and steam railroad sections, and the sections of public administration and public safety. The meeting of the public safety division on the afternoon of Sept. 17 will include an address on "City Planning as Related to Public Safety," by Thomas Adams of the Conservation Commission of Ottawa, Canada.

Engineering Employment Service Not Military

Some engineers apparently have assumed that the new division of engineering, United States Employment Service, is a military organization, for the Chicago office of the division has been flooded with requests for enrollment which indicate a desire for military service.

This belief is false. The division which has offices at 29 So. La Salle St., Chicago, is a Government free employment agency for civilian work. It provides work for engineers and technical men, free of charge. It places these men with industries that are doing war and nonwar work, according to the desires of the applicant. It also furnishes men who are needed immediately for work in departments of the war and the industries. There are no obligations and no fees. The division, however, furnishes a means of direct contact with the Government and gives advice and help in regard to military enlistments.

Contractors' Committee to Meet Before Loan Drive

Sept. 23 has been set as the date for the meeting at 51 Chambers Street, New York City, of the executive committee appointed to form a national organization of contractors.

The change, it is announced, advancing the original date one week from Sept. 30, was made because of the number of members of the committee found to be on Liberty Loan committees in their own cities, making it difficult for them to be absent during the first week of the coming drive.

Appoints Committee for Study of After-War Conditions

W. H. Finley, president of the American Association of Engineers, has appointed a committee to study after-the-war conditions. The committee consists of Isham Randolph, chairman; Edmund T. Perkins, consulting engineer, Chicago; Gardner S. Williams, consulting engineer, Ann Arbor, Mich., and Samuel Moreell, Chicago, secretary. The committee will be increased as its gets into the work and will join forces with other agencies in Chicago and throughout the country that are now studying the problem.

Approve Mayor's Nominations for Boston Transit Commission

The Massachusetts Civil Service Commission has sent to Mayor Peters of Boston its approval of the names of the three men designated by the mayor to act as transit commissioners of the city. These men will take charge of the work formerly performed by the Transit Commission, which expired June 30 after an existence of nearly a quarter of a century.

The men whose names have been approved are former Mayor Josiah Quincy, who was a member of the old commission; Thomas F. Sullivan, public works commissioner, and Thomas W. Murray, city treasurer.

The Civil Service Commission also approved the names of Herbert A. Wilson, building commissioner, to succeed Patrick A. O'Hearn, Thomas Allen, art commissioner, and James B. Shea, park and recreation commissioner.

Fleet Corporation Fights Mosquito Pest

Local Authorities Coöperating With Shipping Board in Washington, at Many Yards

Almost over night a great national mosquito-fighting army has been created by the health and sanitation section of the industrial relations group through the United States Shipping Board, Emergency Fleet Corporation. This force is conducting a continuous offensive against the pest which for a time threatened to undermine the morale of hundreds of thousands of employees of shipyards and auxiliary plants. Lieut. Col. Philip Schuyler Doane, a member of the staff of Surgeon-General Gorgas at the time he eliminated the mosquito pest from the Panama Canal Zone, is director of the department of health and sanitation of the United States Shipping Board, and is organizing the war against the mosquito in all parts of the United States where there are shipbuilding activities.

At the Hog Island shipyard, a comprehensive campaign has been inaugurated against the mosquito. There are about 30,000 men employed in this yard, which is situated in a waste of marshes along the Delaware River. The territory included in the mosquito belt covers 14½ square miles, or 9100 acres. After looking over the situation, officials of the Shipping Board's Department of Health and Sanitation decided that an anti-mosquito campaign in the district, to be successful, must be a coöperative one. A conference of the various interests at stake was called and a coöperative plan was adopted. The Emergency Fleet Corporation, the State of Pennsylvania, the City of Philadelphia and the private interests subscribed a war mosquito fund aggregating $250,000 to be spent in drainage, oiling and inspection work. The work is being carried out according to a schedule evolved by the Pennsylvania State Board of Health to which has been given supervision of the whole work in order that all parts of it may be properly coördinated.

Methods of mosquito elimination employed include the sprinkling of pools with oil, the cutting down of high weeds which form prolific breeding places, and the digging of lateral ditches in the 9100-acre tract. Within three months after work was inaugurated the water area was reduced by 95 per cent. Breeding had been virtually stopped.

With the coöperation of local authorities, the fleet corporation is carrying out similar work at many other points.

Make Gasoline Mileage Tests with New Army Trucks

Utilizing 5 two-ton motor trucks of the "Army A" type, tests were made Sept. 4-6 of gasoline consumption when the trucks were operated over various road surfaces, paved and unpaved, in the vicinity of Cleveland. The trucks were taken from stock made by the White Co. just previous to delivery to the Government. The roads traversed ranged from earth on which rain had fallen two days before, to excellent semi-monolithic brick and concrete in good condition. Stretches of good and poor gravel and an uneven asphaltic macadam were included. The lengths varied from 1.1 to 5.6 miles.

The main purpose of the tests was to show the fuel cost of operation, loaded and empty, over paved and unpaved sections of country roads, rather than a detailed scientific study of draw-bar pulls or engine efficiency. The results will be available as soon as worked up.

The tests were carried out as a co-operative enterprise between the White Co. and the Portland Cement Association. Representatives of the Lakewood Engineering Co., the United States Office of Public Roads, city and county officials and *Engineering News-Record* were present and assisted in making the observations.

District of Columbia Improvements Postponed for War Work

Engineering and construction forces of the District of Columbia will be transferred as far as feasible from district improvements to Federal war construction, according to a recent decision of the district commissioners. It is hoped that the labor shortage in Washington will be relieved soon enough to permit the district expenditures for construction authorized in the appropriations for the current year.

Typhoid Carrier Causes Epidemic

Presence of a "typhoid carrier" in a farm dairy caused a recent typhoid epidemic at Wheaton, Ill., with three deaths. The state authorities and the typhoid expert of the Chicago Health Department were called in by the local health officer. Tests of milk sent from this farm to Chicago were satisfactory, as pasteurization of such milk is required.

Distinguished Service Crosses for Engineer Officers

In the list of officers and men to whom the Distinguished Service Cross has been awarded and who have been mentioned in army orders by General Pershing, appear the names of George Winfield Kuehlman and James Stanley Colton, second lieutenants of engineers.

The order states that on the night of Aug. 5-6 Lieutenant Kuehlman was sent to make a reconnoissance of all possible means of crossing the River Vesle near Fismes. It had been reported that the Germans had all retreated from the south bank of the river, but he found that such was not the case; they were there in force. Nevertheless, such were his bravery and determination that he crossed into and through the German lines, made a full reconnoissance and returned with his report.

From Aug. 4-6 Lieutenant Colton successfully carried out a reconnoissance for the location of possible bridge sites across the River Vesle, near Fismes. He was constantly under heavy shell fire and was frequently harassed by fire from hidden machine gun nests in the town. He passed, however, beyond our furthest lines and obtained the desired information. He was wounded before his mission was accomplished, but refused to return to his battalion until he had made his reconnoissance and had been relieved by another detail.

Brockton Postpones Building Its Activated-Sludge Plant

The State Board of Health having advised further sewage-treatment experiments, Brockton, Mass., has postponed until after the war the building of its proposed activated-sludge plant. The board advised further experiments with both activated sludge and sprinkling filters of small-sized stone, the filters to be deeper than those of the present installation. H. S. Crocker is city engineer and superintendent of sewers.

ENGINEERING SOCIETIES

Calendar

Annual Meetings

AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS; 304 East Walnut St., Bloomington, Ill.; Oct. 2-4, Buffalo, N. Y.

AMERICAN PUBLIC HEALTH ASSOCIATION; 126 Massachusetts Ave., Boston, Oct. 14-17, Boston.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS; A. Dennis Williams, Morgantown, W. Va., acting secretary; Dec. 2-6, Chicago.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS; 29 West 39th St., New York City; Dec. 3-6, New York.

The Duluth Engineers' Club held a dinner and meeting on the evening of Sept. 9, which was addressed by Sidney J. Jennings, president, and Bradley Stoughton, secretary, of the American Institute of Mining Engineers, and Horace Winchell, mining engineer. The date of the dinner was arranged to coincide with the date of the meeting of the western group cost data committee of the President's Conference Committee on Railroad Valuation. Arrangements were made for the use of the assembly room of the Duluth Commercial Club all day on Sept. 9 for the Cost Data Committee meeting. For the benefit of the Cost Data Committee the club also conducted a trip to the Mesaba range, which required the making up of three parties, on account of difficulties in train schedules. The first party left Duluth Monday evening and the other two on Tuesday morning.

The meeting of the American Association of State Highway Officials which was scheduled for Oct. 7-9, in Chicago, has been postponed to Dec. 2-6.

The Southern Appalachian Good Roads Association will hold its annual meeting in Asheville, N. C., Nov. 19-21.

The Engineers' Society of Milwaukee (the Milwaukee section of all national engineering societies) held its regular monthly meeting Sept. 11 under the auspices of the Milwaukee section of the American Institute of Electrical Engineers. E. R. Shepard, associate electrical engineer of the United States Bureau of Standards, delivered an illustrated address on the work of the bureau with special reference to local electrolysis surveys.

PERSONAL NOTES

WILLIAM G. THOMPSON, state highway engineer of New Jersey and previously assistant to Gen. George W. Goethals in the building of New Jersey's highway system, has been granted leave of absence by the Highway Commission for the period of the war to enter military service. It is stated that Mr. Thompson will probably receive the rank of lieutenant colonel.

H. H. RUSSELL, assistant division superintendent of the Pennsylvania R.R. at Pittsburgh, has been appointed division superintendent at Williamsport, Penn., succeeding H. P. Lincoln, who has been made special agent at Williamsport. Mr. Russell entered the service of the Pennsylvania in 1895 as rodman, and became successively trainsitman, assistant supervisor, supervisor, division engineer and assistant division superintendent.

L. H. GOEBEL has resigned as superintendent of filtration and chief chemist of the water filtration plant of the Union Stockyard and Transit Co., Chicago, to become associated with the engineering staff of the Wallace & Tiernan Co., manufacturer of chlorine control apparatus and sanitary engineering specialties. Mr. Goebel's headquarters will be in Chicago.

A. DANIELS has been appointed district engineer of the northern district of the Chicago, Milwaukee & St. Paul Ry., with offices in Minneapolis.

A. S. CLARSON has resigned his position as city engineer of Verdun, Que.

C. ARTHUR POOLE, city engineer of Rochester, N. Y., has received a commission in the Engineering Corps, U. S. Army, as a captain.

W. R. POWRIE has resigned as district engineer of the Chicago, Milwaukee & St. Paul Ry. at Minneapolis, Minn.

F. C. BLACK, city engineer of Hoquiam, Wash., has resigned to become instructor of mathematics in the Oklahoma City schools. He has been succeeded by William L. Lovejoy, of the engineering department of Aberdeen, Wash. Mr. Lovejoy served a previous term as city engineer of Hoquiam.

GEORGE C. D. LENTH, assistant chief engineer of the Board of Local Improvements, Chicago, has entered on Government work as engineer for M. J. Corboy, who has the contract for installing the water and sewer systems at the Field Artillery Firing Center at Stithton, Ky.

T. R. BURKE has been appointed engineer in charge of highway improvements in the Lewisburg, West Virginia district, succeeding Frank K. Rader, county road engineer, who has been commissioned as first lieutenant in the Engineer Officers' Reserve Corps and assigned to duty at Camp A. A. Humphreys, Virginia.

R. B. BALL has been appointed chief engineer of the coast lines of the Atchison, Topeka & Santa Fé Ry., with office at Los Angeles, Cal. He succeeds G. W. Harris, now chief engineer of the Atchison, Topeka & Santa Fé Railway system and his former position as engineer of a grand division has been abolished.

HUGO E. SURMAN, district engineer for the State Highway Division of Illinois in District No. 2, with headquarters in Moline, has received additional charge of District No. 1. The Moline office is being closed and the two offices are to be consolidated at Aurora for the duration of the war.

WILLIAM BOWIE, hydrographic and geodetic engineer and chief of the Division of Geodesy of the United States Coast and Geodetic Survey, has been commissioned as major in the Corps of Engineers, and assigned to duty in map-making work.

HARRY B. HOMMON, sanitary engineer, United States Public Health Service, has been commissioned as captain in the Sanitary Corps, United States Army.

T. T. IRVING, division engineer of the Grand Trunk Ry. at Chicago, has been appointed chief engineer of the Grand Trunk Western Lines, with headquarters in Detroit.

BURTON J. ASHLEY, sanitary engineer, Chicago, has been engaged for and is now making a sanitary survey of the mining town of Benham, Ky., with reference to improving the water-supply and disposal of sewage, and outlining a sanitary program for the town.

MELVILLE C. WHIPPLE, instructor in hygiene and sanitation, Harvard University, has been commissioned as captain in the Sanitary Corps, United States Army.

CURTIS S. GILES, for the past four years city engineer of Crookston, Minn., has become acting city engineer of Grand Forks, N. D., and will carry on the engineering work of the city in conjunction with Prof. E. F. Chandler, head of the Engineering Department of the University of North Dakota, who has been named city engineer.

AUGUSTUS HUNT, assistant city engineer of Minot, N. D., has been appointed city engineer of Crookston, Minn., succeeding Curtis S. Giles, resigned to become acting city engineer of Grand Forks, N. D., as noted above.

J. H. BROOKS, JR., of the engineering department of the Norton Co., Worcester, Mass., who was previously with the Northwestern Pacific Ry., with headquarters in San Francisco, has been commissioned as first lieutenant in the Engineer Officers' Reserve Corps and assigned to duty at Camp A. A. Humphreys, Virginia.

G. F. HAYDEN, chief engineer of the Continental, Fidelity-Phoenix, and American Eagle Fire Insurance companies since 1915, has been appointed consulting engineer and will be succeeded as chief engineer by C. W. Pierce, at present engineer of all three companies in the New England field.

GEORGE E. WILLCOMB, sanitary engineer, Albany, N. Y., has been commissioned as captain in the Quartermaster Corps and assigned to duty at Camp Dix, New Jersey, as assistant to utility officer.

SHELDON S. YATES, of the firm of Yates & Yates, consulting engineers, New York City, is now at the Field Artillery Officers' Training Camp at Camp Zachary Taylor, Kentucky.

W. H. KIRKBRIDE, assistant division superintendent of the Southern Pacific Co. at Sacramento, Cal., has been appointed chief engineer, succeeding William Hood, who, it is understood, will remain with the Southern Pacific's outside properties, including the Southern Pacific de Mexico. Mr. Kirkbride was graduated from Stanford University in 1895. For three years thereafter he was in private engineering and with a United States deputy mineral surveyor. In 1898 he became assistant chief engineer on the location and construction of the Sierra Railway of California, remaining on this work until 1902. He entered the service of the Southern Pacific in 1903 as assistant engineer. From 1904 to 1906 he was roadmaster; from 1906 to 1909, assistant division engineer. In 1909 he was made division engineer at San Francisco, two years later was transferred to Sacramento, and subsequently was made assistant division superintendent.

OBITUARY

CAPT. O. L. CAMERON, of the Canadian Expeditionary Forces, died recently in France from wounds received in battle. Until the time of his enlistment Captain Cameron was in charge of waterway surveys for the water-works department of the city of Toronto. He was a graduate of the School of Practical Science, Toronto, class of 1913. He enlisted with the 208th battalion, but was transferred to the 54th battalion and reverted to the rank of lieutenant in order to hasten his departure for France. He was again advanced to the rank of captain shortly before his death.

CAPT. OSCAR LLOYD HOUSEL, 38th Regiment of Engineers, U. S. A., died Aug. 19 from pneumonia, contracted while his regiment was extending railroads into the newly regained territory of the allies. Captain Housel was 43 years old and was a graduate of the University of Illinois. On leaving the university in 1898 he was commissioned as first lieutenant and fought in the Spanish-American War.

LIEUT. J. IVAN DAPPERT, engineer and son of James W. Dappert, consulting engineer, Taylorville, Ill., who has four other sons in the army, was killed in action on the western front Aug. 11. He was 31, and recently received a commission in the 132nd U. S. Infantry. His early engineering experiences were as assistant in his father's office, on private and Government dredging work, foreman on railroad work in Texas, and concrete construction in California. He was prominent in labor circles in that state, being at one time state secretary of the American Federation of Labor. He was also a member of the Illinois Society of Engineers.

CHARLES A. MILLER, city engineer of Oregon City, Ore., for the past three years, died suddenly Aug. 22. Mr. Miller was born in Centerville, Iowa, in 1861. He went to the Pacific Coast many years ago and was engaged on engineering projects in Oregon for about 25 years. He had charge of the construction of the Willamette Falls Ry. line and on its completion became superintendent, which position he held for more than 20 years, until the line was purchased by the Southern Pacific.

NEWS OF ENGINEERING INDUSTRIES

FOR MANUFACTURERS WHO SERVE ENGINEERS AND CONTRACTORS

Four Classes of Industrial Priority Named by War Industries Board

Intended as Selective Mobilization of Industry for Winning War Rather Than as Embargo on Those Not Listed

Four priority classifications for industry have been issued by the War Industries Board. The classification will act as a selective mobilization of industry to aid in winning the war and it is stated that the list is elastic and will not act as an embargo on those industries not mentioned. In this connection the bulletin announcing the list states that the preference list is made up of industries and plants which in the public interest are deemed entitled to preferential treatment. The effect of the inclusion of these industries and plants on the list will be to defer the requirements of all other industries and plants until the requirements of those on the preference list shall have been satisfied. While it is very necessary that high ratings be made in order to stimulate production to meet the abnormal demand or depleted supply of war requirements, some ratings will be made on products the intrinsic importance of which may be less than those in lower classifications, on account of the fact that the supply of the products of higher value is already meeting the demand without the stimulus of high priority. The aim, it is further stated, is a well-balanced production program including all the important factors.

The four classes are summarized as follows:

CLASS I

Plants principally engaged in producing aircraft, supplies and equipment, ammunition for the United States and the allies, ordnance and small arms for the United States and the allies, chemicals for explosives, ammunition and aircraft used in chemical warfare, metallurgical coke and by-products, including toluol, explosives for military purposes, feed for livestock and poultry, food, including cereals and cereal products, meats, including poultry, fish, vegetables, fruit, sugar, syrups, glucose, butter, eggs, cheese, milk and cream, lard, lard compounds, oleomargerine and other substitutes for butter or lard, vegetable oil, beans, salt, coffee, baking powder, soda and yeast, and ammonia for refrigeration, fungicides, oil and natural gas for fuel or mechanical purposes (including pipe lines and pumping stations), toluol (gas plants), ships, other than pleasure craft or vessels not built for the United States or the allies or under license of the Shipping Board; steel plants, plants producing solely steel ingots and castings by the various processes; domestic consumers of fuel and electric energy for residential consumption, including homes, apartment houses, residential flats, restaurants and hotels; coal mines, arsenals, cantonments and camps of the army and navy yards, railways operated by the United States Railroad Administration, maintenance and operation of ships, excluding pleasure craft not common carriers and maintenance of public buildings used as hospitals or sanitariums.

CLASS II

Plants principally engaged in producing locomotive or traveling cranes, rolling and drawing copper, brass and other copper alloys, coke not otherwise classified and listed, ferro alloys, machine tools and wire rope, blast furnaces producing pig iron, steel rail mills (producing rails over fifty pounds a yard), construction work of the war or navy departments in embarkation ports, harbors, fortifications, flood protection operations, docks, locks, channels, inland waterways and in maintenance and repair of same, mines producing metals and ferro alloy minerals, street railways, electric lighting and power companies, gas plants not otherwise classified, telephone and telegraph companies, water supply companies and like general utilities, railways not operated by the United States, excluding those operated as plant facilities.

CLASS III

Plants engaged principally in producing food not otherwise listed, not including soft drinks, confectionery and chewing gum, ice, mining tools and equipment, equipment and supplies for producing or transporting oil or gas for mechanical purposes, iron and steel chains, electrical equipment, explosives not otherwise listed, tin plate, and small or hand tools for working wood or metal, fuel and electric energy for domestic consumers not otherwise listed, steel rolling and drawing mills not otherwise listed, maintenance of public buildings other than those used as hospitals and sanitariums.

CLASS IV

Laundries, plants engaged principally in producing and manufacturing hemp, jute and cotton bags, manufacturing chemicals not otherwise listed, medi-

(Concluded on page 517)

All German-Owned Industries To Go Under Hammer

Holdings Amounting to $600,000,000 to be Sold to Break German Grip on American Trade

All industrial plants and other industries owned by alien enemies are to be sold at public auction. No secret sales will be made except by order of President Wilson, and he will not order such to be done without positive evidence that such action is absolutely necessary for the public welfare. These announcements were made by A. Mitchell Palmer, alien property custodian, at a recent luncheon with New York editors. He further stated that if Congress will take the action on certain plans which he recommends the proceeds of these sales may amount to more than $600,000,000, and will go toward paying the claims of Americans against the German Government immediately instead of waiting for adjustment at the peace conference.

Mr. Palmer stated that the alien-owned property in the United States was being divided into two distinct classes. One class contains the small investments made by individuals in Germany who had bought American securities with their savings. The other class contains large plants and extensive financial operations which show plainly a widespread and deeply-laid plan of invasion of American industrial life, with the clear intention of domination. The ramifications of this German industrial invasion were so far-reaching and complete that when brought to light so as to reveal their true intent they proved to be extremely startling, said Mr. Palmer.

The first intention of the Trading with the Enemy Act was to have this property taken in trust by the alien property custodian, and the properties operated or managed so that the financial returns would continue to flow and would be deposited in the United States Treasury. The properties were to have been held intact for possible return to the owners after the war. These properties were found to be very lucrative and under the industrial activities of today were becoming more and more valuable. Consequently, Mr. Palmer recommended and Congress passed an amendment whereby the German owners would not benefit by the prosperity these industries now enjoy. Mr. Palmer announced that if he will have sufficient time before the end of the war all of these industrial holdings will be so completely disposed of that it will be impossible for the German financiers to recover even a vestige of their former power. At the auction sale every

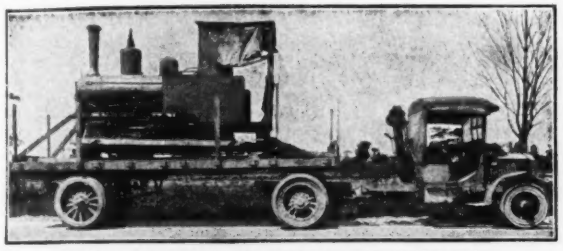
purchaser will be thoroughly scrutinized and every possible precaution taken to prevent the property from reverting to its original owners.

The alien property custodian's force is today the greatest trust corporation in the United States, stated Mr. Palmer, the total value of the properties now being held in trust amounting to more than $600,000,000, and perhaps even to $1,000,000,000.

Motor Truck and Trailer Solve Transportation Problem

A problem recently confronting the road commissioners of Wayne County, Michigan, for transporting materials and equipment to remote portions of the county was solved by the use of motor trucks and trailers. The largest item was the hauling of an industrial locomotive weighing 10 tons.

The scarcity of freight cars, with embargoes, etc., making the transportation of supplies for road work in various parts of the county difficult, caused the Wayne County commissioners to study every possible means of relief. From their base at Wayne they are compelled to haul supplies and equipment to the farthest sections of the county and are often rushed to keep supplied the several crews of road workers. The commissioners state that the varied nature of these supplies and the long hauls presented a problem that was complex. One of these outfits is shown in the illustration and consists of a 10-ton, Fruehaus, semi-trailer manufactured by the Fruehaus Tailer Co., Detroit, Mich., used with a four-ton motor truck.



TRUCK AND TRAILER IN HIGHWAY WORK

Hospital Plans Not to Interfere with Chemical Exposition

The plans of the United States to convert the Grand Central Palace, New York City, into a base hospital will not interfere with the Fourth National Exposition of Chemical Industries to be held there Sept. 23-30, according to information received from the chemical industries. The report states that 350 exhibitors have signed contracts to date for space, which means that all of the floor space will be filled.

It is said that high officials of the Government consider the exposition of such importance that they do not desire to interfere with its success.

Priority Classes Named

(Concluded from page 516)

cines and medical and surgical supplies, fertilizers, fire brick, gray iron and malleable iron castings, food containers, insecticides and fungicides, soap, tanned leather and tanning extracts, cotton and woolen textiles, including spinning, weaving and finishing cotton and woolen knit goods, textile machinery, binder twine and rope, plants engaged exclusively in manufacturing boots and shoes, plants engaged exclusively in manufacturing pulp and paper, cotton compressing, plants engaged principally in producing newspapers or periodicals which are entered at the post office as second class matter, plants preserving, drying, curing, packing and storing tobacco, but not for manufacturing and marketing.

In compiling the list, plants and industries have been divided into the four classes according to their relative importance. In determining the relative importance, consideration has been given to the following factors: (1) the intrinsic importance of the product for war use and the urgency in point of time for the demand of this use; (2) the necessity for increasing the total quantity of production, depending upon the relation of the supply to the demand for essential uses; (3) the proportionate capacity of the industry or plant devoted to the production of the essential product.

Under certain circumstances, it is stated, individual plants have been found to be entitled to preference, although the general industry to which they belong is not, and in other cases where an industry has been accorded a degree of preference, particular plants might be placed in a higher order. This has made necessary the classifying and listing not only of industries but to a certain extent of individual plants, and where it has been found to be necessary to speed up the production of a particular product required at a particular time in connection with some important program, a high priority will be given although changing conditions may thereafter demand a reclassification. Certain plants produce commodities of great relative importance, but at the same time produce other commodities of less relative importance, and under such conditions weight is given to the ratio of production between the more and less important commodities. Instances may arise where a plant may be given preference on account of a local public demand for a particular service, although taking the country as a whole the supply of that product is ample to meet demands.

It is announced that requirements of industries in Classes II, III, and IV will in general have precedence over those not appearing on the list. As between these three classes, however, there will be no absolute preference, the division into classes being for the purpose of presenting the relative importance of the industries and plants in each group. It is not intended that the requirements of any of the higher groups shall be fully satisfied before supplying any of the requirements of the following, but should there be a threatened shortage in the supply of labor or raw material the higher classifications will be served first and those following will be served from a possible surplus.

BUSINESS NOTES

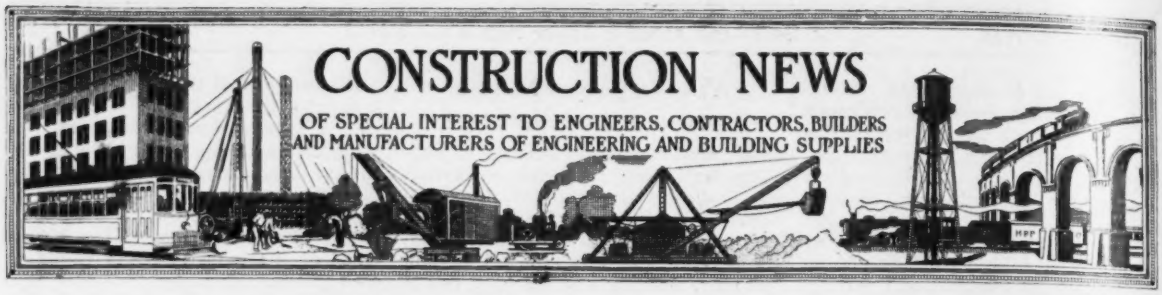
The La Salle Portland Cement Co., La Salle, Ill., which was reported as doing a business approximately $3,000,000 a year, has been taken over by A. Mitchell Palmer, alien property custodian, on the ground that 72 per cent. of its stock is held in Germany. A recent note in *Engineering News-Record* announced that the company had changed its name from the German-American Cement Co. to that given above.

The Chicago Pneumatic Tool Co. announces that contract has been let and work started on the erection of an addition to its Cleveland plant. It is expected that work will be completed on the building itself about Nov. 1. The equipment, it is believed, will be ready for installation by the time the building is completed.

TRADE PUBLICATIONS

Northwestern University devoted one of its weekly bulletins to the descriptive, the courses of study and other information regarding the evening classes in the school of commerce for 1918-19. The schedule of subjects suggested for the present school year, which may be modified on account of war conditions, is as follows: Business administration, accounting, advertising and selling, banking and finance, factory management, foreign trade, public service, secretarial work, transportation.

The Permanent Highways Corporation, 50 E. 42nd St., New York City, has issued a 20-page pamphlet, 6 x 9 in., on its "National" pavement, composed of bitumen and finely pulverized earthy material mixed by the company's machines.


CONSTRUCTION NEWS
OF SPECIAL INTEREST TO ENGINEERS, CONTRACTORS, BUILDERS
AND MANUFACTURERS OF ENGINEERING AND BUILDING SUPPLIES

Building Work Shrinks More Than Half Since 1914

Totals of Contracts let Measured by Increased Circulation of Money Shows Rapid Decline

A comparison of building operations in the United States since 1910 shows approximately constant figures until 1917 when rapid decline in value occurs. In spite of the large Government contracts that have been let since the declaration of war in 1917, the total for 1918 at the present rate will be less than half that of 1914 and less than one-third that of 1916.

The total contracts let the first seven months of 1918 throughout the United States as compiled from the Construction News Section of *Engineering News-Record* amounts to approximately $416,000,000. The building permits issued for twenty of the largest cities of the United States amount to approximately $161,000,000, making a ratio to the total work of 1 : 2.58. Applying this ratio to the building permits issued by the twenty large cities from 1910 to 1917 inclusive, the totals amount to approximately $1,393,000,000 for 1910; $1,388,000,000 for 1911; $1,429,000,000 for 1912; $1,287,000,000 for 1913; $1,194,000,000 for 1914; $1,302,000,000 for 1915; $1,605,000,000 for 1916; $1,029,000,000 for 1917 and at the rate of $416,000,000 for 7 months of 1918—$710,000,000 for the year.

Owing to the increasing amounts of currency in circulation, costs of materials and labor have risen so rapidly that an equitable comparison is impossible without this factor. Prior to 1916 the average per capita money circulation was approximately $34.50; in 1916 it was $39.34; in 1917, $45.64, and for the first seven months of 1918, $49.67. Multiplying the totals of the years of 1916-17 and 18 by the ratio of the per capita circulation prior to 1916 to that afterward will give totals that can be compared to the pre-war figures on a more equal basis.

The per capita ratio for 1916 is (34.5 : 39.3) = 0.88; that for 1917 is (34.5 : 45.6) = 0.76, and for 1918 is (34.5 : 49.7) = 0.69. Multiplying the volumes of business given above by the corresponding ratios gives $1,412,000,000 for 1916, $768,000,000 for 1917 and $499,000,000 for the whole of 1918 at the rate of the first seven months.

Of the total of $416,000,000 for contracts let reported in *Engineering News-Record*, $200,000,000 is work by the Federal Government; $147,000,000 is for the construction of industrial plants, and $69,000,000 is for non-industrial work.

Federal Government work is rapidly reaching its limit because the period of construction is giving way to the period of production and this holds true to a large extent with industrial plants. On the other hand, the scarcity of labor and raw materials has become such that the Priorities Committee has found it necessary to protect the supply by still more stringent rules. A pledge is now exacted from all applying for priorities on building materials wherein the manufacturer must guarantee that none of the materials sold shall go into any construction other than that contributing directly toward winning the war. The manufacturers say that it is impossible to obtain such a pledge. Each contractor having an unfinished job must get his priorities from the commissioner in order to permit the manufacturers to sell goods to a dealer who supplies the contractor.

A committee of building material manufacturers from the New York district were in conference with Washington authorities recently and pointed out that building operations in their district had declined more than 30% the past months on the one hand and that the demand for housing such as commercial, residences and storage had increased abnormally due to the large number of Government requisitions.

The National Federation of Building Industries, in a memorandum sent to the War Industries Board, has recommended that action by the Government be taken establishing a definite point of contact between the Government and the building industry and suggest the creation of a Governmental unit or board with which the builders may deal. Such a unit, they point out, could coördinate all functions involved, for the benefit of the Government and the industry.

Continuing, they point out that at present the building industries are subject to the actions of no less than six administrative agencies:

1. War Industries Board Priorities Committee.
2. War Industries Board, Resources and Conversion Section.
3. The Railroad Administration.
4. The Fuel Administration.
5. U. S. Employment Service of the Department of Labor.
6. Capital Issues Committee of the Federal Reserve Board.

PROPOSALS

For Proposals Advertised See Pages 51-53 inclusive

WATER-WORKS

Bids Close		See Eng. News-Record
Sept. 17	Missouri City, Ia.	Sept. 12
Sept. 20	Tulsa, Okla.	Sept. 12
Sept. 20	Akron, O.	Sept. 12
Sept. 25	Okmulgee, Okla.	Sept. 12

SEWERS

Sept. 13	New York, N. Y.	Sept. 12
Sept. 18	Lakewood, O.	Sept. 12
Sept. 19	Boston, Mass.	Sept. 5
Sept. 19	Garrett, Ind.	Sept. 12
Sept. 19	Fairmont, Minn. Adv. Sept. 12.	Sept. 12
Sept. 24	Macon, Mo. Adv. Sept. 12.	Sept. 12
Sept. 26	Chicago, Ill.	Sept. 5
Oct. 10	Cleveland, O.	Sept. 12

BRIDGES

Sept. 16	Lawrenceville, Va.	Sept. 5
Sept. 16	Fairport, O.	Sept. 12
Sept. 16	Lincoln, Neb.	Sept. 12
Sept. 18	Buckhannon, W. Va.	Sept. 5
Sept. 24	Greensburg, Pa.	Sept. 12
Sept. 25	Meadville, Pa. Adv. Sept. 12.	Sept. 12
Sept. 30	Eldora, Ia.	Sept. 12

STREETS AND ROADS

Sept. 13	New York, N. Y.	Sept. 12
Sept. 16	New Mexico.	Aug. 8
Sept. 16	Chicago, Ill.	Sept. 12
Sept. 16	Idaho	Sept. 12
Sept. 17	Granite Falls, Minn.	Sept. 5
Sept. 18	Uniontown, Pa.	Sept. 5
Sept. 18	St. Clair Heights, Mich.	Sept. 12
Sept. 18	Chicago, Ill.	Sept. 12
Sept. 18	Key West, Fla.	Sept. 12
Sept. 20	Cincinnati, O.	Sept. 12
Sept. 20	Taylorsville, N. C.	Sept. 12
Sept. 21	St. Peter, Minn.	Sept. 5
Sept. 22	Pocahontas, Ark.	Sept. 12
Sept. 24	Wabasha, Minn.	9ug. 29
Sept. 24	Harrisburg, Ark.	Sept. 5
Sept. 25	Pennsylvania. Adv. Sept. 12.	Sept. 12
Sept. 26	Williamson, W. Va.	Sept. 5
Sept. 30	Greensburg, Pa.	Sept. 12

EXCAVATION AND DREDGING

Sept. 16	Bradentown, Fla.	Sept. 5
Sept. 17	Albany, N. Y. Adv. Aug. 22 and 29 and Sept. and 12.	Aug. 22
Sept. 17	Brownsville, Tenn.	Sept. 12
Sept. 17	Caruthersville, Mo.	Sept. 12
Oct. 2	Charles City, Ia.	Sept. 12
Oct. 8	Albany, N. Y. Adv. Sept. 12.	Sept. 12

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